Chromosomes and genetic information

In early 20th century:

- Scientists discovered that genetic information is carried on chromosomes, as they have the same number in the cells of the members of each type of living organisms.
- The genetic information causes the appearance of hereditary traits in living organisms.

⇨ **Chromosomes:**

- Exist inside the cell nucleus.
- They are found in the form of homologous pairs in somatic and gonads.
- Each chromosome consists of DNA and proteins.

⇨ **Number of chromosomes:**

Living organisms have different numbers of chromosomes, while members of the same species have the same number of chromosomes.

⇨ **DNA:** Consists of units called nucleotides.

⇨ **Genes:** A sequence of nucleotides on DNA which represents a codon for building of a certain protein which is responsible for the appearance of a genetic trait.

Types of cells in the body:

	Somatic cells	**sex cells (gametes)**
Produced by	Mitotic division (mitosis) of somatic cells.	Meiotic division (Meiosis) of the gonads (testis and ovary)
No. of chromosomes	Two pairs of homologous chromosomes. Diploid number (2n)	Half the number of chromosomes in the somatic cells of the organism. Haploid number (n)
Such as	Cells of the skin, muscles, blood ……. And so on.	Sperms (human and animals male gametes) Pollens (plant male gametes) Ovum (female gametes of human, plants and animals)

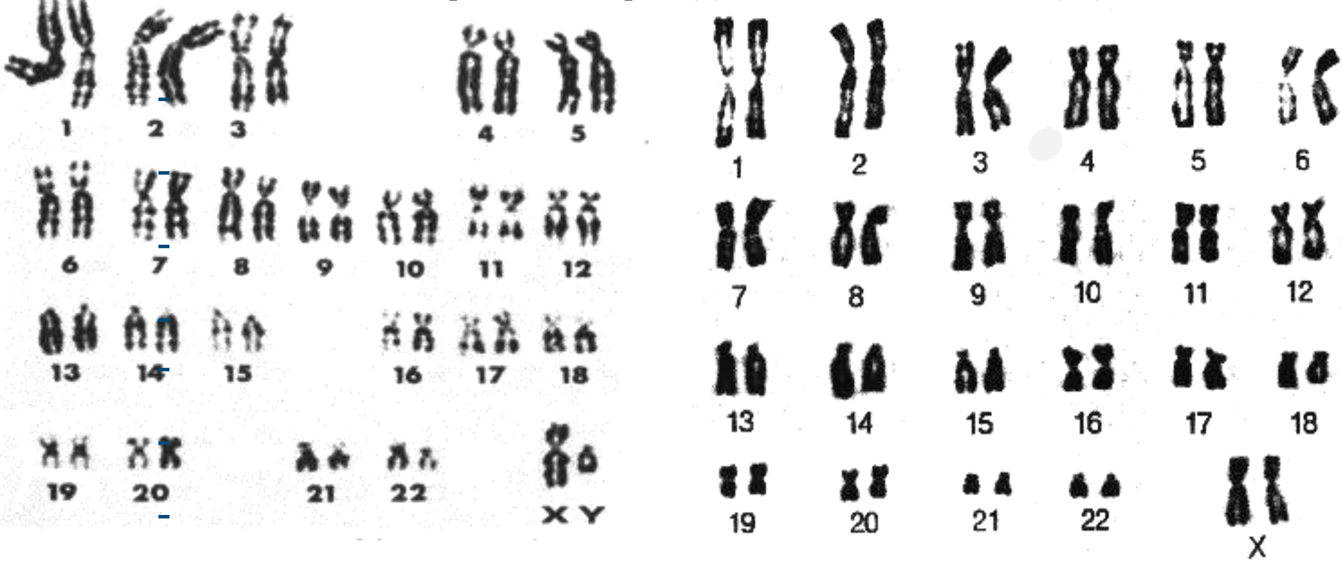
Karyotype

- **It is the arrangement of chromosomes in descending order according to their size and numerating them.**
- **To facilitate the arranging and numerating of chromosomes, they can be colored with**
- **differentcolours**.

→ Human Karyotype:

Nucleus of each somatic cell contains 46 chromosomes (23 pairs), while that of each gamete cellcontains only 23 chromosomes.

- → Chromosomes pairs are arranged in descending order according to their sizes from number (1)to number (23).
- → Chromosomes pairs from (1) to (22) are known as somatic chromosomes
- → Chromosomes pair (23) is called sex chromosomes because this pair carries the geneticinformation responsible for the determination of sex (male or female).
- → Sex chromosomes pair follows pair (7) in size, but its order is (23)



Karyotype of human male (44 + XY)

Karyotype of human female (44+XX)

Karyotype in male:- Sex chromosomes pair in male is non homologous (XY)

Karyotype in female:- Sex chromosomes pair in female is homologous (XX)

Chromosome theory

Scientists Boveri and Sutton put chromosome theory in 1902, which states that:-

1- Chromosomes exist in somatic cells in the form of homologous pairs (2n)

2- Gametes contain half the no. of chromosomes in somatic cells as a result of meiotic cell division;where homologous pairs get separated from each other forming two identical groups

3- Each pair of chromosomes behave independently when being transferred gametes

4- After fertilization process, the normal number of chromosomes (2n) comes back 5- Each chromosome carries hundreds of genes.

A chromosome is made of DNA and protein, DNA carries genes which have thegenetic information of living organisms

sex cells (gametes)	**Somatic cells**
- Produced by meiosis of cells of gonads. - They contain half the number of chromosomes. - They are called haploid number of chromosomes(N), i.e they contain one set of chromosomes. - They are two types: • Male gametes: sperms (in human and animals) orpollens (in plants) • Female gametes (Ova)	- Produced by mitosis. - They contain the complete number ofchromosomes. - They are called diploid number of chromosomes (2N), i.e they contain twosets of chromosomes. - Examples: cells of liver, skin, pancreas, …… etc.

Work sheet

1-Which of the following represents the presence of the shorter chromosome?
(a) All the male somatic cells.
b) All the male gametes.
(C) All the somatic cells and gametes in males.
(d) All the somatic cells and gametes in females.

2- The sperms in human differ from each other in
(a) the number of somatic and sex chromosomes together.
(b) the number of sex chromosomes only.
(C) the type of sex chromosome.
(d) the size of somatic chromosomes.

3-In which of the following the karyotype of the human male differs from that of the female in normal cases?
(a) The number of somatic chromosomes.
(b) The order of somatic chromosomes.
(c) The number of sex chromosomes.
(d)The type of sex chromosomes.

4- Which of the following represents the pair of chromosomes that is directly larger in size than the chromosomes pair no. (8) In a human female karyotype?
(a) (7). (b)(23).
(c)(9) (d)(a) and (b) together.

5- Which of the following doesn't characterize the pair of sex chromosomes in the human female?
(a) It follows the chromosomes pair no. (7) in size.
(b) It is arranged at the end of chromosomes.
(c) It carries the number (23).
(d) It is asymmetric.

6- If you know that the number of chromosomes in the nucleus of a plant stem cell is 42 chromosomes, what is the number of chromosomes in a pollen grain for that plant?
(a)21 (b) 24
(c)42 (d) 84

1- "We always get two identical karyotypes when the meiotic division takes place in the cells in human gonads". How far is this statement correct? With explanation

2-The sex chromosome (Y) is necessary for the human life"
How far is this statement correct? With explanation

Mendel s law according to the chromosomal theory
The complete dominance (The Mendelian cases)

-The Mendelian case is characterized by:

Two phenotypes (dominant and recessive) and three genotypes:

- **It is a genetic case in which the characteristic is controlled by two genes; one of them is dominant while the other is recessive where the effect of the recessive gene is absent in the presence of the dominant gene.**
- **It is characterized by the ratio (3dominant:1 recessive) in the 2^{nd} generation.**

May be:

Dominant phenotype

- Homozygous (pure dominant) AA.
-
- Heterozygous (hybrid dominant) Aa.

Recessive phenotype

- Homozygous (Always pure recessive) (aa).

Mendel's first law: **Law of Segregation of Factors:**

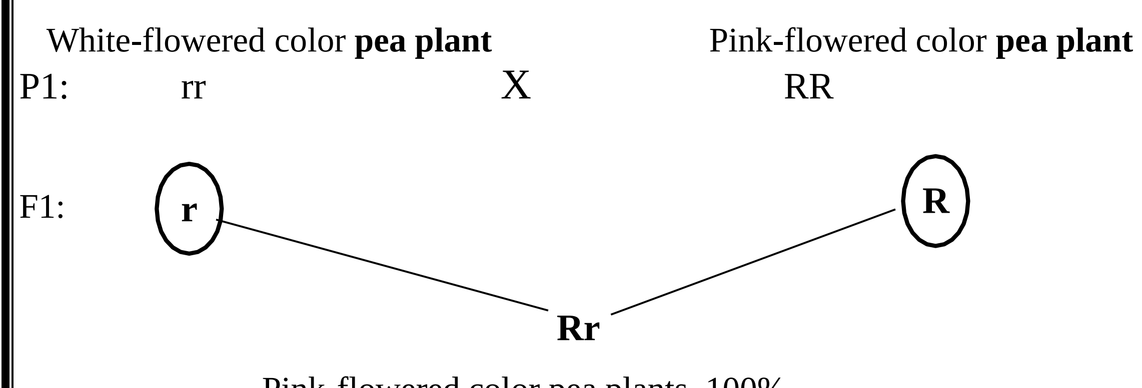
When two pure members that differ in any pair of allelomorphic characteristic are crossed, only the dominant characteristic appears in the F1 generation, while the two characteristics appear in the F2 generation in the ratio of **3 dominant : 1 recessive**.

What is meant by allelomorphic characters?

They are each pair of contrasting (alternating) characteristics is called a, such as the seed colour which may be yellow or green, the flower colour which may be pink or white, and the height of the stem which is either tall or short,…etc.

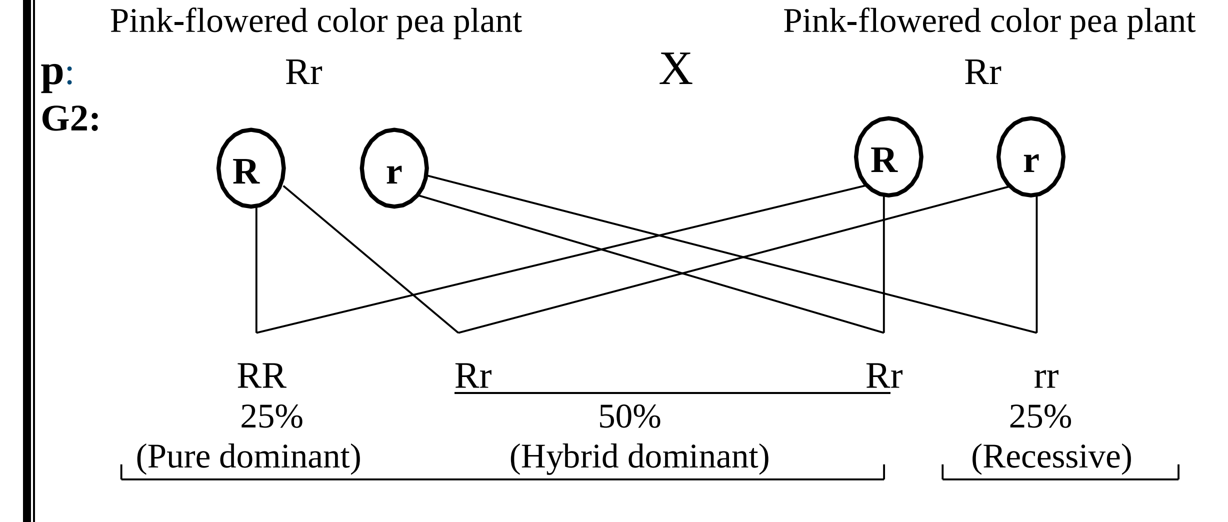
Example

If crossing takes place between a white-flowered color pea plant and another Pink-flowered colorpea plant: the **F1** plants of this cross will be all Pink-flowered color pea plants.



Pink-flowered color pea plants 100%

When the individuals of F1 are left for self-pollination, fertilization takes place, and F2 plants are obtained: they are **pink-flowered colour pea plants**, and **white-flowered color pea plants** in theratio 3 pink-flowered: 1 white flowered.



F2: Pink-flowered color pea plant : White-flowered color pea plant

3 : **1**

The inheritance of some Mendelian characteristics in Man:

Mendel's first law can be applied to some Human characteristics such as hair (dark, and light), (curly, and straight), (dense, and light), the eye colour (brown, and blue), (wide, and narrow), eye-lashes (long, and short), skin colour (normal, and albino), ear lobules (free, and fused), and nose (pointed tip, and flat tip), (curved and straight).

Some abnormalities, and diseases such as deafness (recessive), flat-foot (dominant), high blood pressure (dominant), protrusion of the lower jaw (dominant), short fingers (dominant), memory loss (recessive), and idiocy (recessive).

Mendel's second law (law of independent assortment):

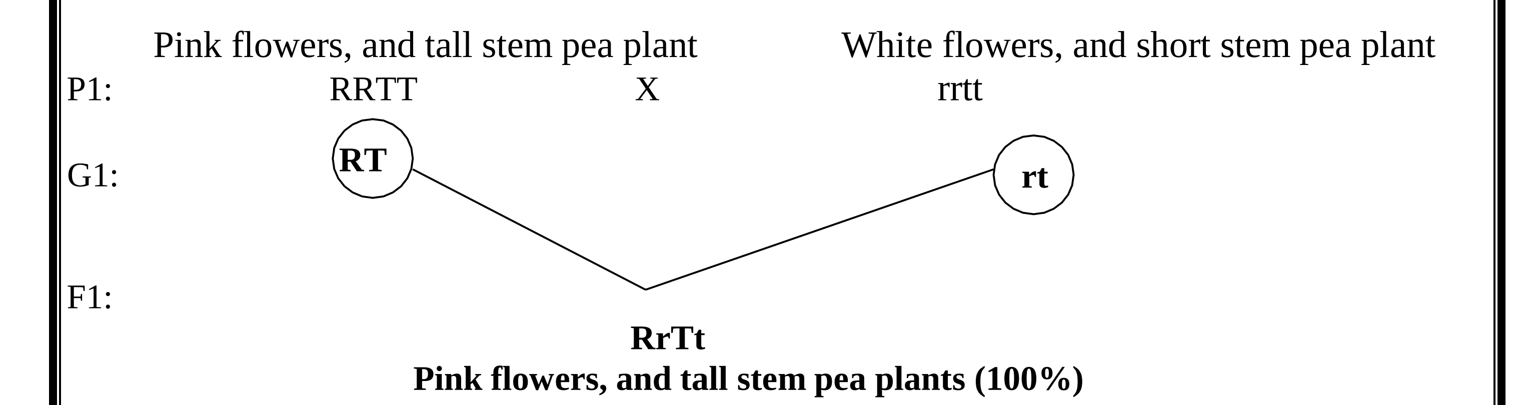
Mendel's first law deals with the inheritance of one allelomorphic characteristic, while **Mendel'ssecond law** studies the inheritance of two allelomorphic characteristics in the same time

Law of the independent assortment of the genetic factors

When two homozygous individuals differing in two (or more) pairs of alleles are crossed, **each pair** of characteristics is assorted at random, and is inherited independently of the other, and willappear in the F2 generation in the ratio

Example :-If crossing takes place between: **one** with pink flowers, and tall stems (two dominant characteristics),whereas **the other** with white flowers, and short stems (two recessive characteristics)

F1 generation: All the produced pea plants were pink-flowered and tall-stemed.



When he left the pea plants of the F1 generation to be self-pollinated,

The individuals of the F2 will be as follows:

P2: **Pink flowers, and tall stem pea plant** X **Pink flowers, and tall stem pea plant**

RrTt **RrTt**

G2: **RT** **Rt** **rT** **rt** **RT** **Rt** **rT** **rt**

F2:

♂ ♀	**RT**	**Rt**	**rT**	**rt**
RT	**RRTT** **Pink, Tall**	**RRTt** **Pink, Tall**	**RrTT** **Pink, Tall**	**RrTt** **Pink, Tall**
Rt	**RRTt** **Pink, Tall**	**RRtt** **Pink, short**	**RrTt** **Pink, Tall**	**Rrtt** **Pink, short**
rT	**RrTT** **Pink, Tall**	**RrTt** **Pink, Tall**	**rrTT** **white, Tall**	**rrTt** **white, Tall**
rt	**RrTt** **Pink, Tall**	**Rrtt** **Pink, short**	**rrTt** **white, Tall**	**rrtt** **white, Short**

The ratio of the above mentioned individuals of F2 is 9: 3: 3: 1

F2 generation :

- Pink-flowered, and tall-stemed plants. 9
- Pink-flowered, and short-stemed plants. 3
- White-flowered, and tall-stemed plants. 3
- White-flowered, and short-stemed plants. 1

Work sheet

1- If you know that the character of albinism is characterized by the absence of melanin Pigment from skin, hair and eyes, where this character is a recessive Mendelian character in human, when mating an albino man with a woman carrying the gene of albinism. What is the probability of the appearance of this character in the offspring?

(a) 25% (b) 50%
(c)75% (d)100%

2- If you know that the gene of detached earlobes character (D) is dominant. When a man with Attached earlobes married to a woman with detached earlobes, all the resulted generation Were with detached earlobes. What are the expected genotypes for the parents?

(a) dd x dd (b) Dd x dd
(c) Dd x Dd (d) DD × dd

(3) If this woman married to a normal man, what is the expected percentage of?

(a) 100% (b) 75%
(c) 50% (d) 25%

4- When children with narrow eyes were appeared for parents having wide eyes, what are the genotypes of the parents?

(a) AA x AA (b) AA x aa
(C) aa x aa (d) Aa x Aa

5- If you know that the green pod colour gene of the pea plant dominates over the yellow pod colour gene, answer the following :

(1) When crossing two pea plants with green pods (hybrid), what is the percentage of the plants with yellow pods in the resulted generation ?

(a)100% (b)50%
(c)25% (d)75%

(2) Which of the following crossings in pea plant won't produce yellow-coloured pods?

(a) Gg x Gg (b)Gg x gg
(c) gg xgg (d)GG x Gg

6 "In complete dominance, the dominant character appears with 50% in the second Generation, when one pair of pure allelomorphic characters is inherited".
How far is this statement correct? With explanation.

7-When a crossing takes place between a pea plant with yellow smooth seeds and Another one having green wrinkled seeds, the numbers of plants in the resulted Generation were, as follows:

- 265 yellow smooth seeds.
- 273 yellow wrinkled seeds.
- 258 green smooth seeds.
- 264 green wrinkled seeds.

In the light of the previous results, what are the expected geno types of the parents?

8-In beet plant, the genetic factor of swollen roots (M) is dominant over the genetic factor of weak roots (m), and the genetic factor of red colour (R) is dominant over the genetic factor of white colour (r). Deduce the genotypes and phenotypes that are resulted From the crossing of two plants having the genotypes (Mmrr) and (MmRr), illustrating The percentage of the appearance of plants with white swollen roots.

The interaction of genes (The non- Mendelian cases)

⇨ In 1860, Scientist Gregory Mendel discovered that every hereditary trait is controlled by a pairof genes, which may be dominant or recessive.

⇨ The Mendelian case is called **complete dominance**.

Dominant trait: Trait which appears in all members of 1st generation
Recessive trait: Trait which disappears in all members of 1st generation and appears in 2ndgeneration at ratio 25%

⇨ After Mendel, Scientists discovered that there are many traits which are not inherited accordingto Mendel's laws, they are called **Non-Mendelian traits**.

⇨ There are some cases of non-Mendelian traits in which the appearance of hereditary traits isaffected by the interaction of genes.

1. Lack of Dominance

- It is a genetic case in which the characteristic is controlled by two genes; none of them dominates over the other but the presence of them together leads to the appearance of an intermediate characteristic.
- It is characterized by the ratio (1:2:1) in the 2nd generation.

Examples of the lack of dominance:

1-The inheritance of flower color of Antirrhinum plants

.2- The inheritance of blood groups in Man.

1- The inheritance of flower color of Antirrhinum plants.

- There are plants of white-flowered color (WW) and others of red-flowers color (RR).
- When crossing is done between the two plants, the F1 individuals didn't have red or white flowers, they had pink flowers. This means that neither the red color of flowers dominates the whitecolor of flowers, nor the reverse.
- When the F1 generation individuals were self-pollinated, the F2 plants were red-flowered, pink-flowered, and white-flowered in the ratio 1 : 2 : 1



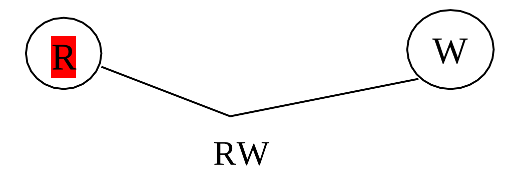
This case can be represented by symbols considering:

R: The gene for red flowers and W: The gene for white flowers

Red-flowered Antirrhinum plant X White-flowered Antirrhinum plant

P RR X WW

G1



F1

RW

(100%)

<u>To obtain the 2 generation:</u>

P2: Pink-flowered Antirrhinum plants X Pink-flowered Antirrhinum plants

RW RW

G2: R W R W

RR | RW RW | WW | |

F2

Red flowered plants : Pink flowered plants : White flowered plants

1 : 2 : 1

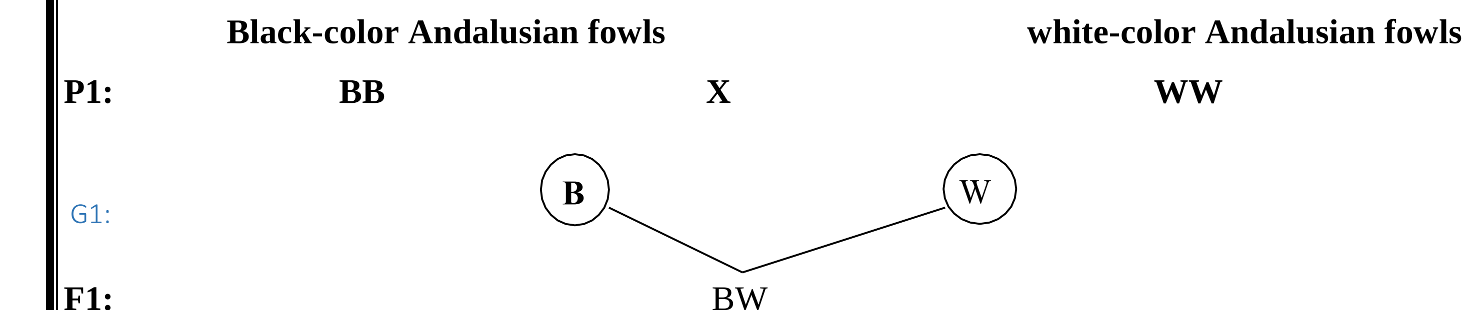
Example :- (2)

There are two types of Andalusian chicken as follows (one of black-color and the other of white- color.

- When crossing takes place between black-colored and white-colored,
- F1 generation will have blue color.
- While F2 generation will have the three colors black, blue, and white in the ratio 1: 2 : 1 Explain this case on genetic bases.

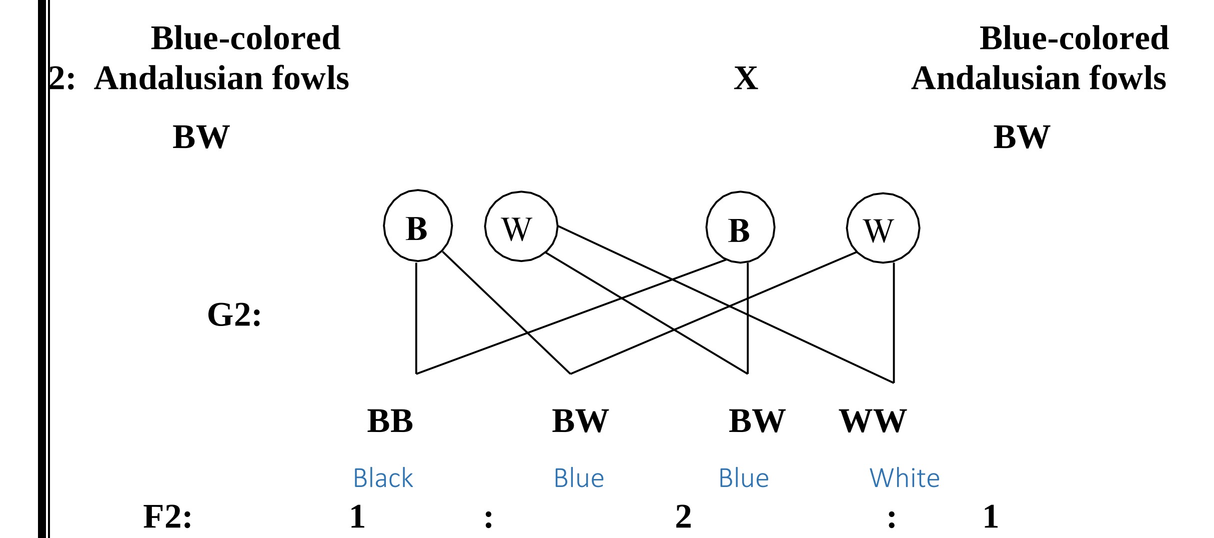
(B) represents the gene for black color,

(W) Represents the gene for white color.



Blue-colored Andalusian fowls (100%)

To obtain the 2 generation:



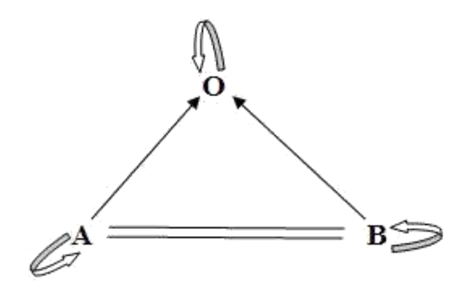
1- The inheritance of blood groups in Man.

- As a result of their studies, scientists classified the Human blood into four main groups: -(A), (B), (AB), and (O).
- This classification referred to a genetic classification and a chemical classification.

Genetic classification of blood groups:

- It was also discovered that these blood groups are inherited as multiple alleles (the genetic traitis controlled by more than one pair of allelomorphic genes), where:
  - There are three allelic genes (A), (B), and (O).
  - Each individual inherits only one pair of these alleles.
  - There are six genotypes (AA), (BB), (OO), (AB), (AO), (BO).
  - Relation between the allelic genes is:
  - (O) is recessive to both (A), and (B) alleles.
  - A case of lack of dominance between (A), and (B) alleles.
  - Phenotypes and genotypes of blood groups:
  - There are 6 genotypes which are represented by 4 phenotypes.
  - The following table represents the phenotypes and the genotypes of the blood groups:

4 Phenotypes	6 Genotypes
Blood group A	**(AA) & (AO)**
Blood group B	**(BB) & (BO)**
Blood group AB	**(AB)**
Blood group O	**(OO)**



Relation between alleles

1- The inheritance of blood groups in Human represents 3 genetic cases:

A-Complete dominance: as both the two alleles (A and B) dominates over the (O) allele.

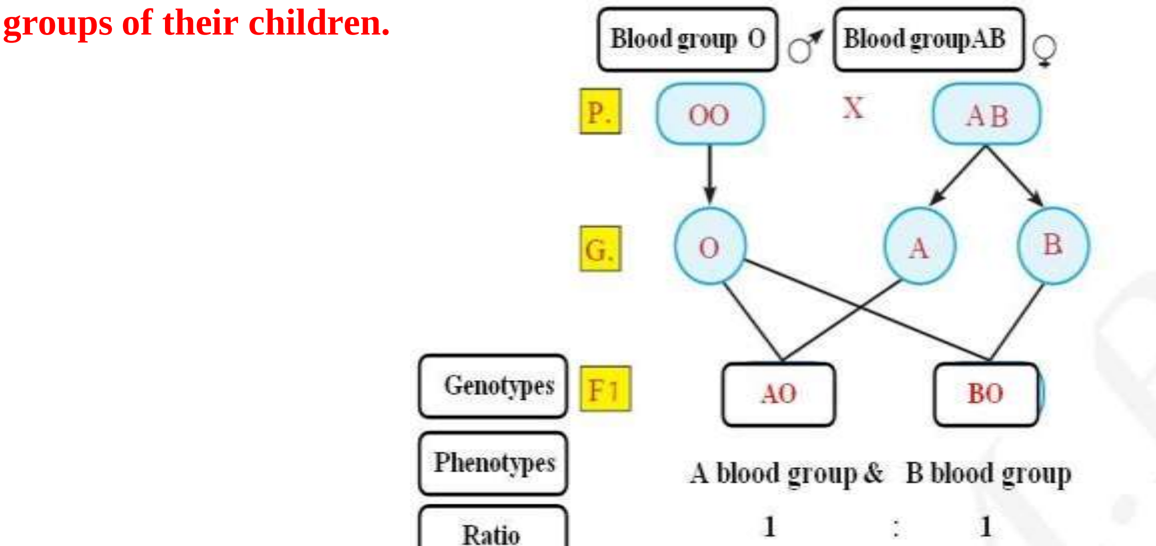
B-Lack of dominance: as the two alleles (A and B) neither on of them dominates over the Other and they produce an intermediate trait (AB)

C-Multiple alleles, as there are 3 alleles control the trait (A, B and O) while the individualinherits only two of them (one pair).

The genotypes can be determined by following up the phenotypes of the parents, And their children, this helps in judging the paternity of disputed children or referring Mixed children to their real parents

Example:

- A man of blood group (O) married a woman of blood group (AB), what are the blood groups of their children.

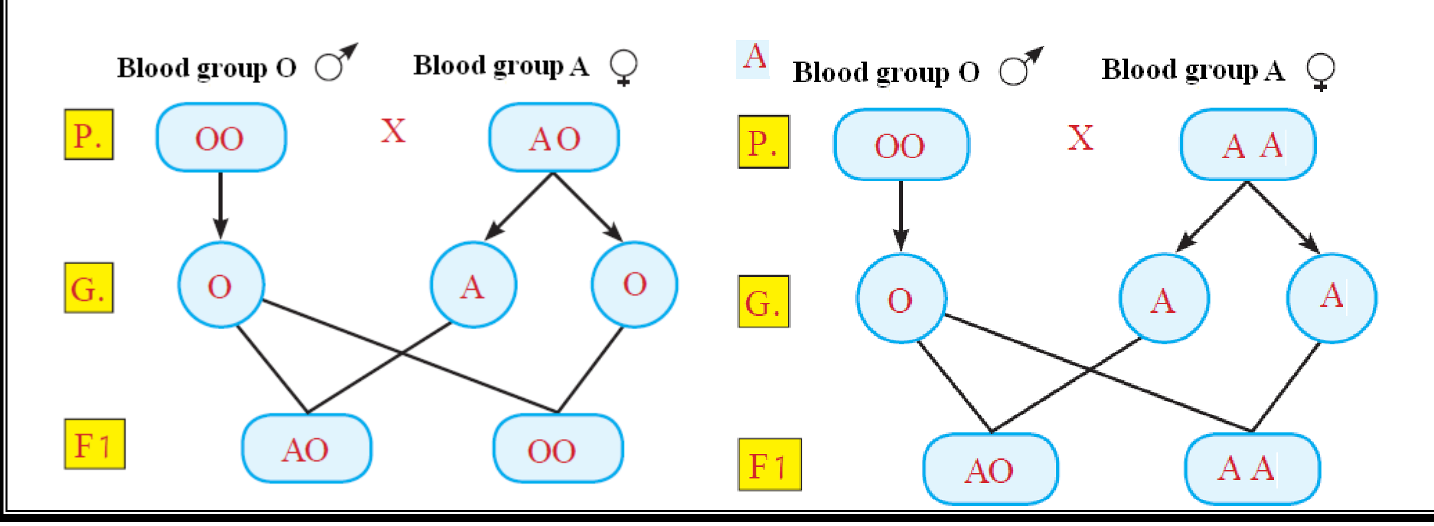


To illustrate the case of two newly born children that were mixed up in the hospital.

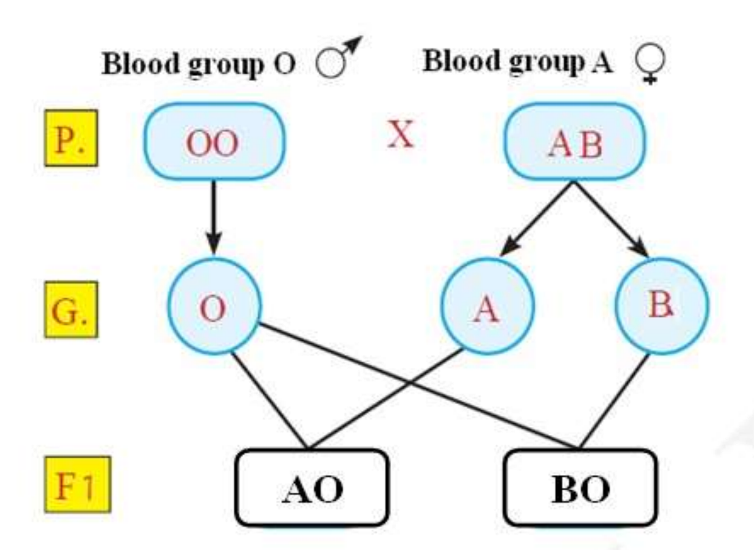
Two fathers argued about the pedigree of a child of **blood type (O)**, if the blood types of both fathers is (O), the blood type of first man's wife is (A), and the second's wife (AB). Which one of those men is more likely to be the father of the child? Why?

Genetic analysis of the first man and his wife:

The genotype of the man is (OO), while the genotype of his wife is (AO) or (AA)



→ Genetic analysis of the second man and his wife:



The genotype of the man is (OO), and the genotype of his wife is (AB)

Therefore, the man who is married to the woman having (A) blood group is

The father of the child.

Chemical classification of blood groups:

Blood groups are classified into 4 groups (A, **B**, **AB** and O)

- This classification is due to the presence of two types of chemical substances in the blood:

Antigens	**Antibodies**
- On the surfaces of red blood cells.	- In the blood plasma.
-They are two types:	-They are two types:
□ **a**	□ **anti-a**
□ **b**	□ **anti-b**

Each type of the blood groups has specific antigens and antibodies.

- **In blood group (A):** there is antigen (**a**) on surfaces of red blood cells, and antibody (**anti-b**) inthe plasma.
- **In blood group (B):** there is antigen (**b**) on surfaces of red blood cells, and antibody (**anti-a**) inthe plasma.
- **In blood group (AB):** there are antigen (**a**), and antigen (**b**) on surfaces of red blood cells, andthere are **no antibodies** in the blood plasma.

They are antigens found on the surface of the RBCs other than the antigens (A) and (B) of the blood groups.

In blood group (O): there are **no antigens** on surfaces of red blood cells, and

- There areantibodies (**anti-a**) and (**anti-b**) in the blood plasma.

Blood transfusion process:-

Blood can be transfused between different blood groups according to the antigens and antibodies.

The following table summarizes the information about blood groups, and their relation to Blood transfusion:

Blood groups	The genotype	Antigen	Antibody	Donor to	Recipient from
A	AA or AO	**A**	**anti-b**	A and AB	A and O
B	**BB** or **B**O	**B**	**Anti-a**	B and AB	B and O
AB	**AB**	A and **B**	--	AB	All groups
O	OO	--	**anti-b**& **anti-a**	All groups	O

N.B.:

Persons with blood group (O) are called universal donors, because blood from group (O) can be safely transfused to any other group.

Persons with blood group (AB) are called universal recipients, because blood can be transfused to them from any other group safely.

- **Blood group determination**

In order to determine an individual's blood group, we should have the following:

- **anti-a** Serum and **anti-b** Serum.
- Two drops of the individual's blood.

- **The procedure:**

1- Put one drop of the individual's blood at the two sides of a microscopic slide.

2- Add a drop of anti. (A) Serum on one of the two blood drops, and a drop of anti. (B) Serum onthe other drop.

3- Observe what happens after stirring separately.

- **Conclusion:**

- If agglutination occurs with **anti-a** serum only:The blood group is (**A**)
- If agglutination occurs with **anti-b** serum only:The blood group is (**B**)
- If agglutination occurs with both **anti-a** and **anti-b** sera:The blood group is (**AB**)
- If agglutination does not occur with any of the two sera:The blood group is (O)

Possible risks of blood transfusion

- There are some risks which the recipient (who takes blood) may be exposed to:-
- When a person receives blood which is not suitable for its type, some symptoms appear on him, such as :-

- Shivering in body.
- Chest pain.
- Blueness.
- low blood pressure.
- Headache

This usually ends with the death of the person

1- **Polluted blood may be transfused to the recipient person, which causes the infection withviruses** (Ex. Hepatitis b virus – AIDS virus)

→ So, blood is being examined before transfusion process in order to make sure it is suitable for therecipient blood, and doesn't carry any pathogenic (disease-causing) organisms.

Importance of the blood groups

1- It helps in the dispute of paternity.
2- It is used in blood transfusion.(and also the type of(Rh)
3- It helps also in Human race taxonomy.

The Rhesus factor (RH)

- **Chemical study of Rhesus factor:**

-It was discovered in the blood of a species of monkey known as **Rhesus** before it was discoveredin the Human blood.

-These antigens are found in about **85%** of the Human individuals, who are known as **Rh^+ persons**,whereas the other **15%** are free from these antigens, and they are called **Rh^- persons**.

- **Genetic study of Rhesus factor:**

- Production of Rhesus antigens is controlled by **three pairs of genes**.
- These genes are very close in their effect, and they are close to each other **on the pair of chromosomes** that carries them.
- The presence of any pair of these pairs of genes in the dominant state leads to an **Rh^+ person**.Thus, Rh^+ persons may be homozygous **Rh^+ Rh^+** , that is the three pairs of genes are found in the

  Dominant state, or heterozygous **Rh^+ Rh^-** , where some of the three pairs of genes are dominant, while the rest are recessive.
- In the Rh^- persons, all his genes are recessive and the person will be homozygous **Rh^- Rh^-**.

Blood types according to blood groups and Rh

The following table summarizes the chemistry of blood group system and Rh factor.

	A+	A−	B+	B−	AB+	AB−	O+	O−
Antigens	**a , Rh**	**a**	**b, Rh**	**B**	**a, b, Rh**	**a , b**	**Rh**	**--------**
Antibodies	**anti-b**	**anti-b**	**anti-a**	**anti-a**	**-------**	**-------**	**anti-b anti-a**	**anti-b anti-a**

Importance of the genetic study of Rhesus:-

The antigens of Rh factor naturally **has no antibodies in the plasma of persons**, however the bodyof a person can form antibodies for the Rh factor (anti-Rh) when:

- Transfusion of blood from a positive Rh person to a negative person or,
- During mixing between the bloods of a negative Rh mother with a positive Rh baby during giving birth (delivery).

Example:
If a woman (Rh-) is married to a man (Rh^+) their children will be:

- 100% Rh^+ children, if the father was homozygous (Rh^+ Rh^+).

- 50% Rh^+ children, and 50% Rh- children, if the father was heterozygous (Rh^+ $Rh^{-)}$.

* If the fetus is Rh+ and the mother is Rh-, some of the blood that leaks from the fetus to the mother's blood during giving birth stimulates it to produce antibodies against the Rhesus factor (**anti-Rh**), normally the first baby is not usually affected.

- The second baby receives an amount of the antibodies that pass to the baby through the placentaand causes disintegration of the his red blood cells, infecting the fetus with

- severe anemia, which may lead to his death, **unless**:

- The mother is injected with a **protective serum** after the birth of the first baby (during 72 hoursat most) this serum breaks down the red blood cells that leak from the blood of the baby and carrythe antigens of Rh before they stimulate the immune system of the mother to produce anti-Rh.

- **(N.B)**

If the father was (Rh^+ Rh^-), the second baby **may be (Rh^- Rh^-)** as his mother, in this case he will notbe affected by the Rhesus antibodies of the mother's blood even if his mother did not take the **protective serum.**

Work sheet

1- Which blood group contains antibodies (anti-a) only?
(a) (A). (b)(B).
(c)(AB). (d)(0)

2- A man with blood group (A) married to a woman with blood group (B), they gave birth to a child with blood group (0), what are the genotypes of the parents blood groups
(a)AA x BB (b) AO x BB
(C) AA x BO (d) AO x BO

3 A mother whose blood group is (AB) has a son with the same blood group, what is The excluded blood group for the father?
(a)A (b) B
(C) AB (d) O

4- How many genotypes of the blood groups containing antigens (A) or (B) and Containing antigens (A) and (B) together?
(A) 3 (b) 4
(c)5 (d)6

5- When a man with blood group (AB) married to a woman with blood group (O), what is the percentage of giving birth to children having the same blood groups of parents?
(a) 75% (AB) and 25% (0). (b) 0% (AB) and 0% (0).
(c)50% (AB) and 50% (0). (d) 25% (AB) and 75% (0).

6- Which of the following blood groups have antigen (B) ?
(a)(A) and (0). (b) (B) and (0).
(c)(AB) and (B). (d)(AB) and (A

7- A man whose blood group is (A) married to a woman has the same blood group, what is the genotype that wouldn't appear in the offspring?
(a) AO (b) AA
(c)BO (d) OO

8-What is the excluded genotype for the blood group of a man married to a woman with Blood group (AB) and they gave birth to a child with blood group (A) ?
(a)(00). (b)(AB).
(c) (BO). (d)(BB).

9- In a strain of ornamental sparrows, a crossing took place between two orange-feathered sparrows and the resulted generation from the crossing was as follows :
•86 red-feathered birds.
• 161 orange-feathered birds.
•93 yellow-feathered birds.
(a) What is the genetic pattern controlling the inheritance of this trait? Explain your answer.
(b) Give reason for: the appearance of individuals with new colours that differ from the parents.

10 "When crossing two pure individuals that differ in a pair of genetic traits, the ratio of the second Generation is always 3: 1".How far is this statement correct?
Giving two examples

11- What happens if: blood is transfused from a person whose blood group is (AB) to a person whose blood group is (A)?

12- Explain: the person whose blood group is (0) faces a great difficulty when
Needs a blood transfusion.

Complementary Genes

- It is a genetic case in which the trait is controlled by **two pairs of genes**; there must be at least one dominant gene from each pair for the characteristic to emerge (appear).

Each of the two pairs controls the production of a certain enzyme which affects part of the steps of the appearance of the characteristic, if one of the two dominant genes was absent, the steps of the appearance of the characteristic will not be completed.

Example for the complementary genes

Inheritance of the flower color of Pea flower plant (sweet pea):

-When two strains of white-flowered Pea plants were crossed, all the flowers of

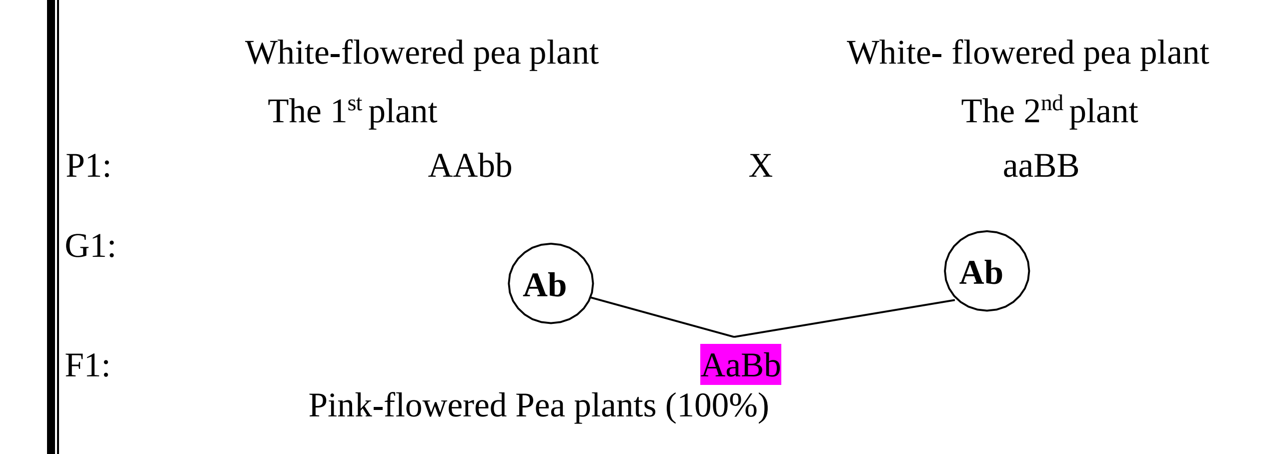
-In F1 plantsappeared pink.

-In F2: the flowers produced were 9 pink: 7 white, this indicates the presence of two pairs of genesthat control the flower color characteristic.

-If the dominant gene in one pair is represented by A, and the recessive gene in that pair isrepresented a.

-If the dominant gene in the second pair is represented by B, and the recessive gene in that pair isrepresented by b.

-The genotypes of the white-flowered pea plants (P1) would be (AAbb) and (aaBB). Then thegenotype of F1 plants will be (AaBb) as follows:

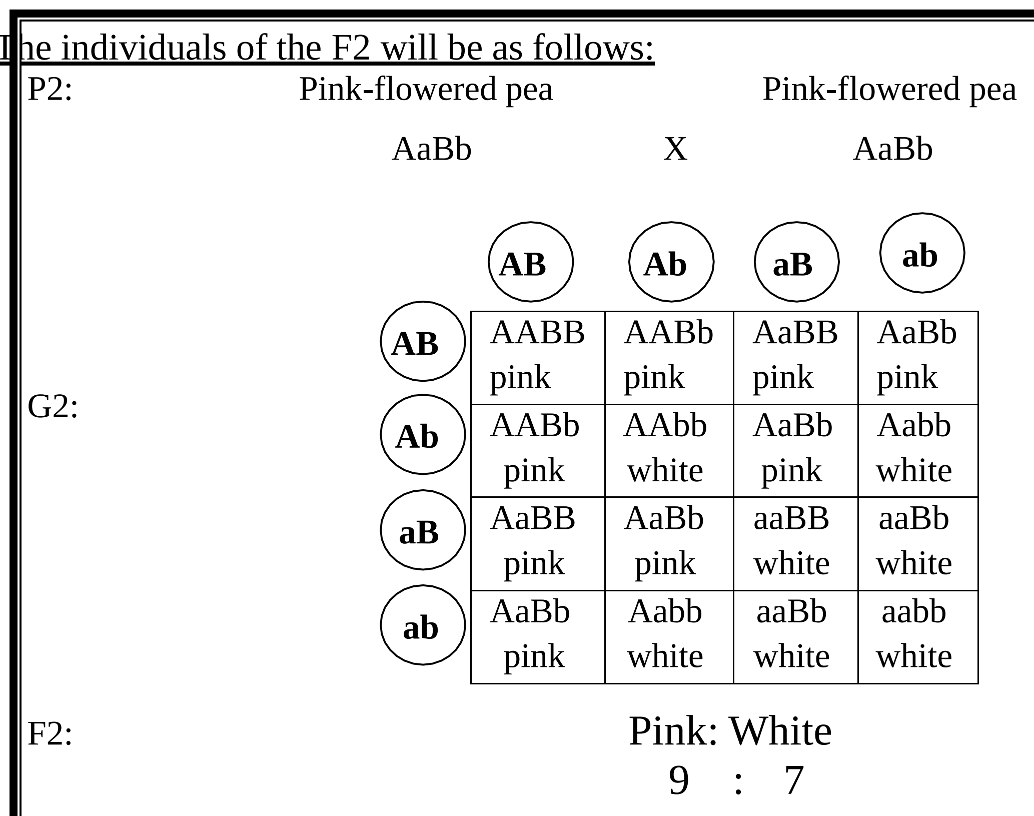


The individuals of the F2 will be as follows:

P2: Pink-flowered pea Pink-flowered pea

AaBb X AaBb

G2:



	AB	Ab	aB	ab
AB	AABB pink	AABb pink	AaBB pink	AaBb pink
Ab	AABb pink	AAbb white	AaBb pink	Aabb white
aB	AaBB pink	AaBb pink	aaBB white	aaBb white
ab	AaBb pink	Aabb white	aaBb white	aabb white

F2: Pink: White

9 : 7

- Conclusions:

1- The appearance of the ratio 9 pink: 7 white emphasizes that this characteristic is **influenced bytwo pairs of genes.**

2- The ratio 9:7 is considered as a deviation from the Mendelian ratio 9:3:3:1 **because** the last

Three genotypes **(3:3:1)** have the same phenotype.

(**Note**: the Mendelian ratio deals with two pairs of allelomorphic traits)

3- **In order for the pik color of flowers to appear**, the two pairs of genes must be present in thedominant state (whether the homozygous or the heterozygous).

4- The white color of flowers appears. If only one pair is found in the dominant state, and the otherpair in the recessive state or both pairs are found in the recessive state.

5- Thus, both pairs of genes participate in the color production. Since, each of them controls theproduction of a certain enzyme which affects part of the steps of the pigment production.

6- If one of the two dominant genes (A or B) was absent, the steps of pigment production will notbe completed, and the flowers appear white.

Lethal genes

They are some genes that control some characteristics when found in a pure (homozygous) state (dominant or recessive), lead to the disruption of some vital processes and leading to the death of almost 25% (one fourth) of the offspring at different stages of life.

There are two types of lethal genes

1-Dominant lethal genes	**2-Recessive lethal genes**
1-gene of yellow fur in mice YY **2-gene of buldog strain in cattels (DD)**	**1- Genes of chlorophyll absence in corn plant(cc)** **2-Genes of infantile dementia in human (aa)**

1- Inheritance of yellow fur colour in mice:

- The fur colour in mice is inherited by 2 genes:

The gene of yellow fur colour (Y) which dominates over the gene of the grey fur colour (y).

When two hybrid yellow mice (Yy) mate, the ratio of produced generation is 1:2, where:

- Pure yellow mice (represent about ¼ of the offspring) died because they carry pure lethal dominant pair of gene (YY) which causes the death of mice in mother´s uterus.

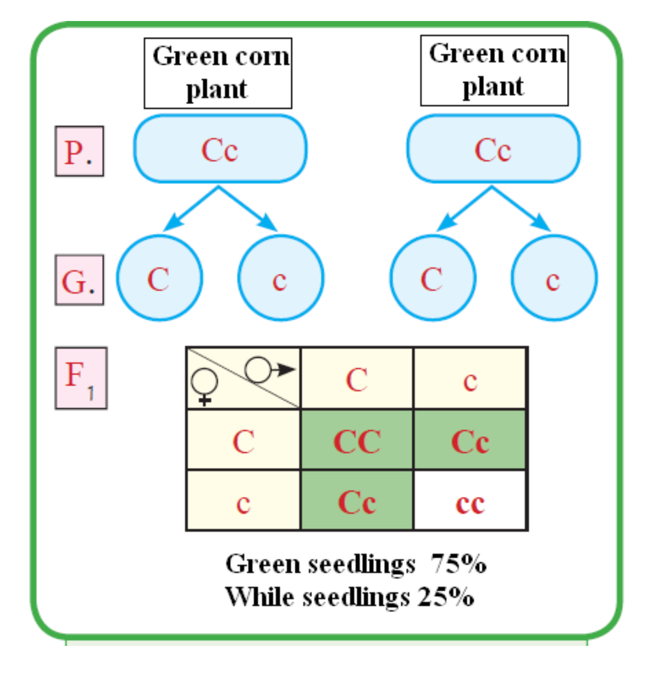
2-Inheritance of chlorophyll absence trait in corn plant (- Recessive lethal genes)

- When some corn plants self-pollinated, they produce white seedlings which don't have

Chlorophyll. These seedlings grow for a short time, then they wilt and die. This happens

Because of a pure recessive lethal gene (cc) which is the gene of absence of chlorophyll.

- When two recessive lethal genes aggregate together in some individuals, chlorophyll Will not be
- Formed in them. Chlorophyll gives the plant its green colour and it is responsible for absorbing light rays to carry out photosynthesis process
- a Plants carrying (cc) pair of genes are white and not able to perform photosynthesis process which causes their death



The effect of environmental conditions on action of some genes

The work of some genes is affected by the factors surrounding living organisms, such as:

- Air pollutants
- Lack of oxygen (oxygen deficiency)
- Exposure to radiation.
- Some environmental factors (Ex. Light – temperature).
- The study of these factors helps us in avoiding the risks resulted from them.

The effect of absence of light on chlorophyll trait in green plants

Experiment 1:

Germinate a group of wheat or corn grains in an illuminated place and irrigate the seedlings regularly for several days.

- Observation:

Green seedlings grow due to the presence of light factor which is needed by the gene that is responsible for the formation of chlorophyll to show its effect.

Experiment 2:

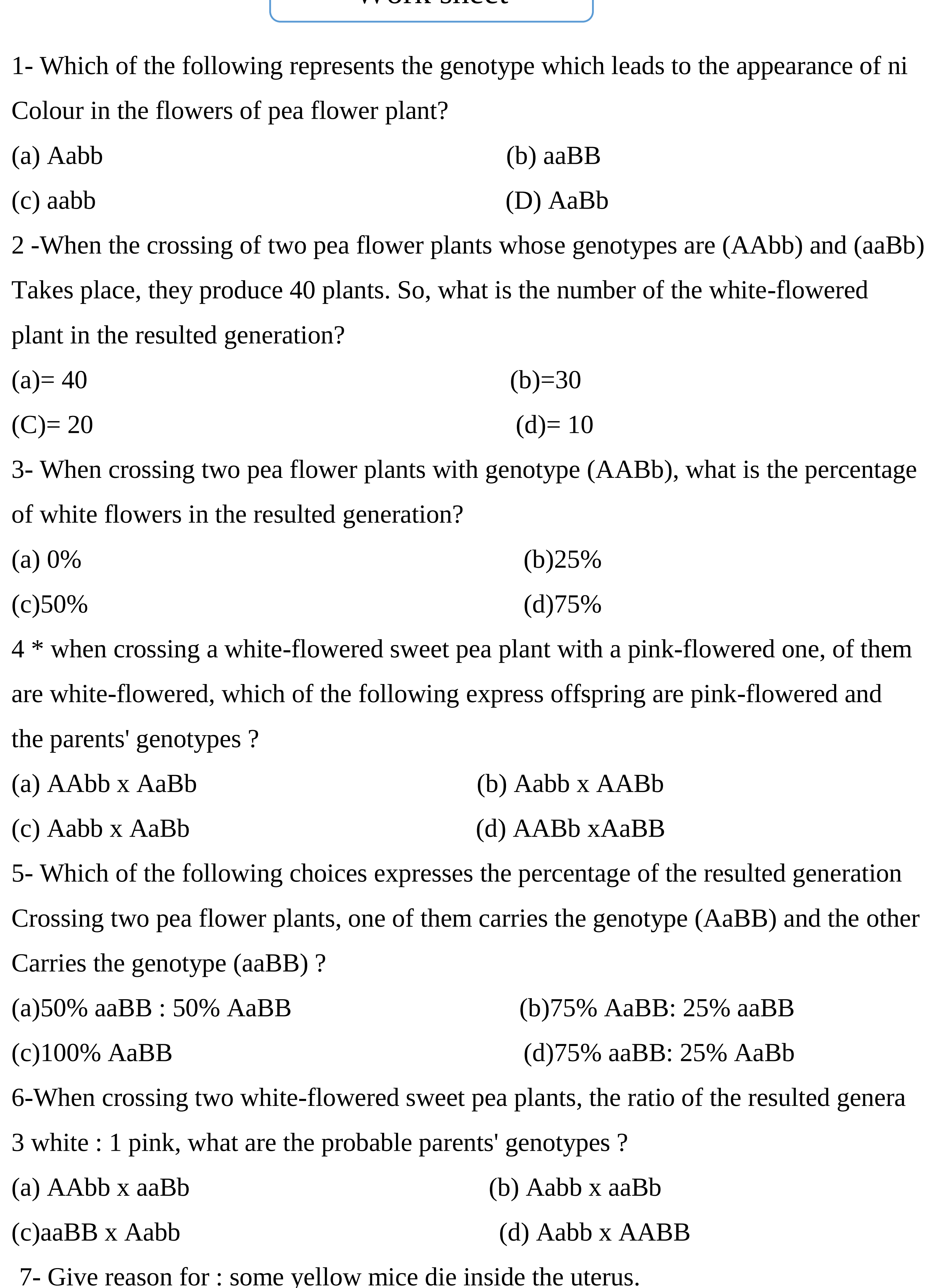
Germinate a similar group in a dark place and irrigate the seedlings regularly for several days.

- Observation:

Yellow seedlings grow then wilt and die after a period of time due to the absence of light factor which is needed by the gene that is responsible for the formation of chlorophyll to show its effect

- .Conclusion:

- The gene responsible for chlorophyll formation in green plants needs the light factor to show itseffect.
- In the absence of the gene causing the appearance of chlorophyll, the plant cannot form the chlorophyll pigment ,even if it was placed in the light
- **The internal cabbage leaves are white-colored**, because they are not exposed to Light needed for appearing the effect of the gene that is responsible for the formation Of green Chlorophyll pigment, on contrast **the external leaves are green-colored**, due to their continuous exposure to light which helps in the formation of chlorophyll.
- **When exposing the internal cabbage leaves to light**, they are changed to green, due to theappearance of the effect of green chlorophyll gene.



Work sheet

1- Which of the following represents the genotype which leads to the appearance of ni Colour in the flowers of pea flower plant?

(a) Aabb (b) aaBB

(c) aabb (D) AaBb

2 -When the crossing of two pea flower plants whose genotypes are (AAbb) and (aaBb) Takes place, they produce 40 plants. So, what is the number of the white-flowered plant in the resulted generation?

(a)= 40 (b)=30

(C)= 20 (d)= 10

3- When crossing two pea flower plants with genotype (AABb), what is the percentage of white flowers in the resulted generation?

(a) 0% (b)25%

(c)50% (d)75%

4 * when crossing a white-flowered sweet pea plant with a pink-flowered one, of them are white-flowered, which of the following express offspring are pink-flowered and the parents' genotypes ?

(a) AAbb x AaBb (b) Aabb x AABb

(c) Aabb x AaBb (d) AABb xAaBB

5- Which of the following choices expresses the percentage of the resulted generation Crossing two pea flower plants, one of them carries the genotype (AaBB) and the other Carries the genotype (aaBB) ?

(a)50% aaBB : 50% AaBB (b)75% AaBB: 25% aaBB

(c)100% AaBB (d)75% aaBB: 25% AaBb

6-When crossing two white-flowered sweet pea plants, the ratio of the resulted genera 3 white : 1 pink, what are the probable parents' genotypes ?

(a) AAbb x aaBb (b) Aabb x aaBb

(c)aaBB x Aabb (d) Aabb x AABB

7- Give reason for : some yellow mice die inside the uterus.

8-Give reason for : the lethal genes are inherited from hybrid individuals only.

9-What happens when : germinating seedlings of corn plants in a dark place?

Sex determination in Man

The sex of an individual is determined by a special type of chromosomes called **sex chromosomes.**

- Usually one or two of these sex chromosomes exist in each cell of the individual, and the rest ofthe chromosomes are called **autosomes** (somatic chromosomes).

→ **In the past**, it was thought that woman controls the sex of her fetus, but when scientists discovered sex chromosomes, they discovered that **man** controls the sex of the fetus (not woman)

- In the nucleus of human somatic cells, there are 23 pairs of chromosomes (46 chromosomes).

There are 2 types of chromosomes in the somatic cells:

Autosomes (somatic chromosomes)

- Their number is 22 pairs (44).
- Identical in males and females.

Sex chromosomes.

- Their number is 1 pair (2).
- Differ in the males from the females.

The chromosomal structure in the cells of male and female:

	The cells in the female human	**The cells in the male human**
Chromosomal structure	44 + XX	44 + XY
No. of autosomes	44	44
No. of sex chromosomes	2	2
Types of sex chromosomes	XX symmetric (identical)	XY Asymmetric (not identical)
The gonads	Ovaries	Testes
Gametes	Ova Produced by meiotic division of the ovaries.	Sperms Produced by meiotic division of the testes.
Chromosomal structure of Gametes	All of one type (22 + X)	There are 2 types (22 + X) and (22 + Y)





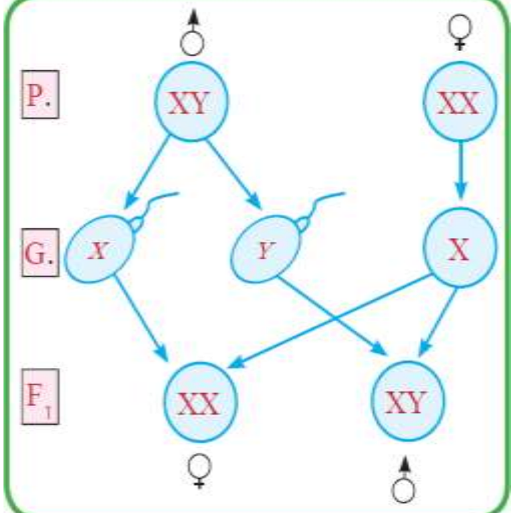
Compare between the sex chromosome X and the sex chromosome Y:

	The sex chromosome X	**The sex chromosome Y**
Size	Larger than Y	Smaller than X
Genes	Carries other genes that have no relation to sex or sexual development.	Does not carry other genes than those of sex determination in mammals.

Probabilities of sex determination for human embryo

The genes responsible for sex determination and carried on the sex chromosomes X, and Y **act only in the first months of Human embryonic development**:

- **After six weeks from the beginning of pregnancy**, the embryo begins the production of male hormones if the Y chromosome is present. These hormones induce the gonad tissues (which are undifferentiated) to produce testes, then the rest of the male genital organs is differentiated.
- **After 12 weeks from the beginning of pregnancy, if the embryo does not contain the Y chromosome**, the embryo begins to form ovaries, then the rest of the rest of the female genital organs is differentiated.



Abnormal cases of number of chromosomes in Humans

Abnormality in number of chromosomes:

Reasons:

- Sometimes, during meiosis for gamete formation, mistakes take place.

- Sex chromosomes are not equally distributed, This leads to abnormal cases, **where**:
In some rare cases, the two sex chromosomes **adhere** closely to each other during meiosis and do not separate, This leads to the presence of the two X chromosomes in one ovum and the absence of the X chromosome from the other.

From the examples of the human abnormal chromosomal cases

1- Klinefelter's syndrome (44+XXY)

Chromosomal structure	44+XXY
No. of chromosomes	47
Sex	Male (due to the presence of (Y) chromosome.
The defective chromosomes	Sex chromosomes
Reason of the case	The fertilization of an abnormal ovum (22 + XX) having two X chromosomes by a normal sperm having Y chromosome (22 + Y)
Reason of the disturbance	The extra X chromosome leads to a disturbance in the balance of the sex determining genes where the female genes that carried on the extra X Chromosome express themselves in some way.
Symptoms	A sterile male due to the absence of sperm generating cells in his testes. Tallness. Appearance of some feminine characters, such as the growth of the Breast´s size.

2- Turner's syndrome

Chromosomal structure	44 + XO
No. of chromosomes	45
Sex	Female
The defective chromosomes	Sex chromosomes
Reason of the case	The fertilization of an abnormal ovum (22 + O), having no X chromosome, by a normal sperm having X chromosome (22 + X)
Reason of the disturbance	The lackage of X chromosome including the genes of unsexual characters that carried on it, leading to the production of a female with several deformation.
Symptoms	A female who does not reach puberty, due to the lack of sufficient amount of hormones. Shortness. The presence of some congenital defects in the heart and the kidneys.
Case discoverer	Dr. Turner in 1938.

3-down's syndrome

Chromosomal structure	The males: 45 + XY The females: 45 + XX
No. of chromosomes	47
Sex	Male or female
The defective chromosomes	Somatic chromosomes (autosomes)
Reason of the case	The fertilization of a normal gamete by an abnormal gamete (ovum or sperm) which carries a pair of chromosomes no. (21)
Reason of the disturbance	The presence of three copies of the chromosome no. (21).
Symptoms	- Growth retardation - - Mental retardation. - - The back of head is flat. - Small ears. - Oval face - Shortness - Convex eyes. - Short fingers and toes.

4-aneupliody (trisomy X)

Chromosomal structure	44 + XXX
No. of chromosomes	47
Sex	Female
The defective chromosomes	Sex chromosomes
Reason of the case	The fertilization of an abnormal ovum (22 + XX) having two X chromosomes, by a normal sperm having X chromosome (22 + X)

Work sheet

1 - Which of the following is resulted when a normal sperm that doesn't contain Chromosome (X) would fertilize a normal ovum?
(a)Turner's case. (b) Normal female.
(c) Normal ma (d) Klinefelter's case.

2- Which of the following is correct when an ovum devoid of sex chromosomes is fertilized by a sperm (22 + Y)?
(a) A normal male is produced. (b)An abnormal male is produced.
(c) A normal female is produced. (d)The ovum dies after fertilization.

3- In which the male with Klinefelter's syndrome is similar to the male with Down's syndrome
(a) The number of sex chromosomes. (b)The number of chromosomes (X).
(c)The presence of chromosome (Y). (d)The number of autosomes.

4- In which Down's syndrome is different in male from female?
(a) The number of sex chromosomes. (b) The type of sex chromosomes.
(c) The number of autosomes. (d)The case symptoms.

5-A In which a female with Turner's syndrome is similar to a female with Down's syndrome?
(a) The number of sex chromosomes. (b) The case symptoms.
(c)The absence of chromosome (Y). (d) The case symptoms

6- What is the number of autosomes in the female gamete of a normal female?
(a)22 (b) 23
(c)45 (d)46

7- What is the number of chromosomes in a somatic cell of a female with Down's syndrome?
(a) 23 (b) 45
(c) 47 (d) 22

8- What is the relationship between: meiosis and the appearance of both Klinefelter’s? The syndrome and Turner's syndrome?

9 "The type of abnormal chromosomes in case of Klinefelter's syndrome differs from That in Down's syndrome". How far is this statement correct? With explanation.

10 Give reason for: Klinefelter's syndrome appears in males only, whereas Turner's Syndrome appears in females only.

Sex-linked traits

Case discoverer: **Thomas Morgan.**

- He found that the genes of some somatic traits are carried on the sex chromosomes.
- He named these traits as sex-linked traits.

They are somatic traits that their genes are located on the sex chromosomes and their appearance is not affected by the sex hormones.

Examples:

1- In Drosophila insect: eye colour.

2- In human: color blindness, hemophilia, muscle atrophy and short-sightedness.

1-The inheritance of Drosophila eye colour

Experiment:

- Morgan crossed a white-eyed male with a red-eyed female, the F1 generation was all red-eyed.So that the red colour of eyes is **dominant** over the white colour of eyes.
- By inbreeding the F1 individuals, he got red-eyed and white-eyed insects in the Ratio 3:1. **However**, the white-eyed insects were all **males**.

Conclusion

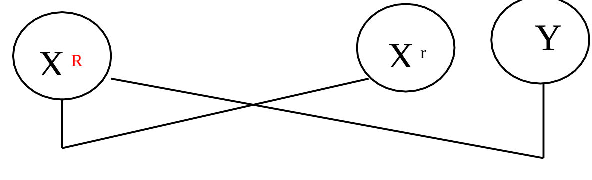
- Morgan explained the appearance of white-eyed males in the F1 generation by Assuming that the gene for the white colour of the eye is recessive and the genes of Eye color is carried on the sex Chromosome X,
- While the sex chromosome Y does not carry the other Allele of the gene, thus,the presence of one gene of the white colour of eyes is sufficient for Males to be white-eyed.
- Morgan called this case sex-linked inheritance to refer to traits that are determined by the geneslocated on the sex chromosome X.

Morgan represented the crossing between white-eyed males, and red-eyed females as follows:

Red-eyed female   White-eyed male

P1: $X^R X^R$ X X^rY

G1:



F1: $X^R X^r$ $X^R Y$

Red-eyed female   Red-eyed male

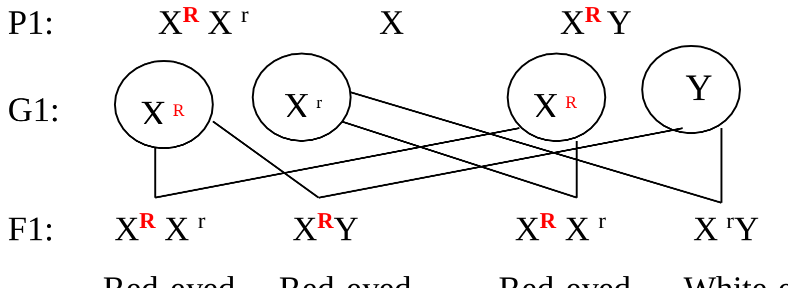
100%   Red-eyed insects

By inbreeding F1 individuals, red-eyed insects and white-eyed insects appear in the ratio 3:1, where the white colour of eyes appears in males only as follows:

Red-eyed female   red-eyed male

P1: $X^R X^r$ X $X^R Y$

G1:



F1: $X^R X^r$ X^RY $X^R X^r$ X^rY

Red-eyed	Red-eyed	Red-eyed	White-eyed
Female	male	female	male

Sex-linked character in human

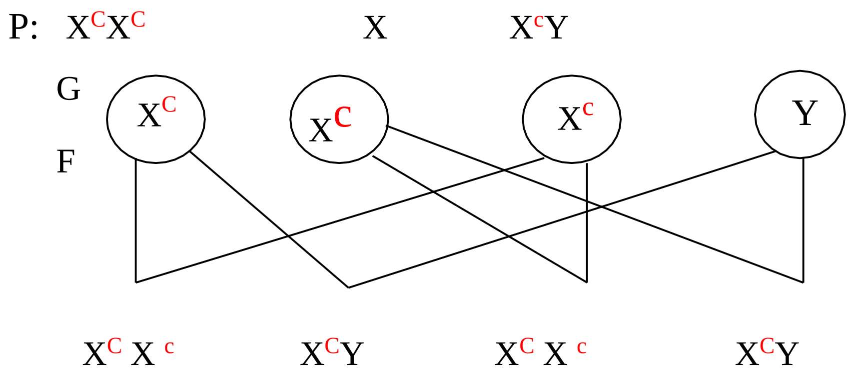
In Man: the genes of some characters on, such as the genes of :-

- Color blindness.
- Hemophilia.
- Muscle atrophy.
- Short-sightedness

The inheritance of colour blindness

- It is a genetic case causes the inability of distinguishing colours, especially The red and green colours
- Example: when a colour-blinded man married to a healthy women (pure),all members of the resulted generation are healthy

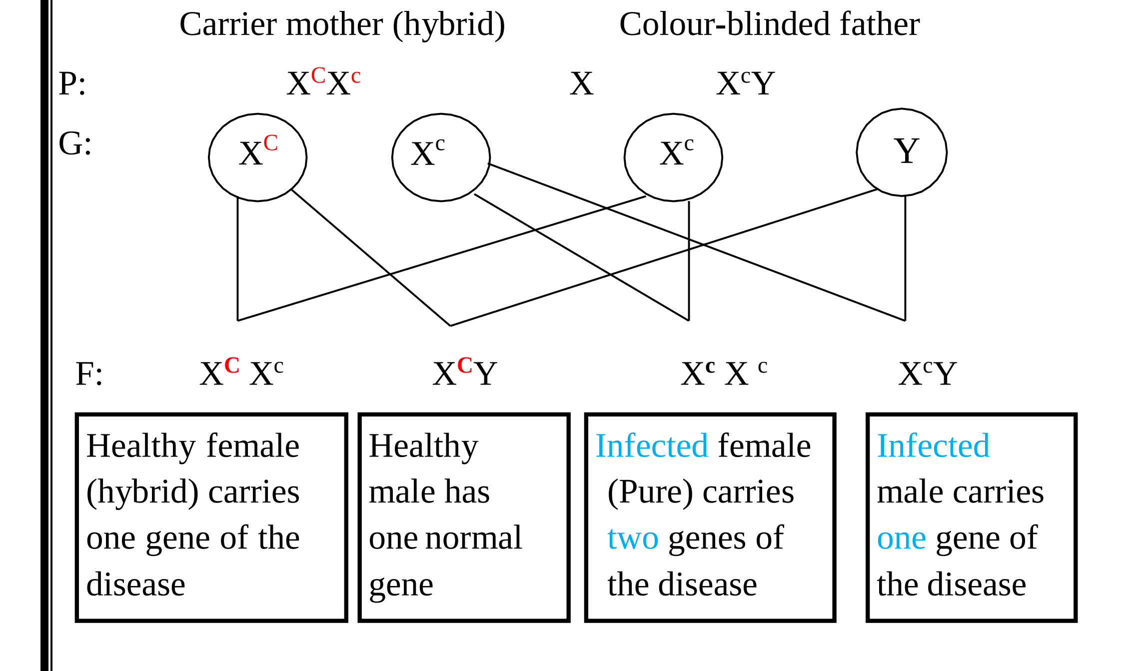
Healthy mother (pure) colour-blinded father



Healthy female: Healthy male: Healthy female: Healthy male

Example 2:

What would happen when a colour blinded man married to a woman that is carrier to the gene of colour blindness (hybrid)



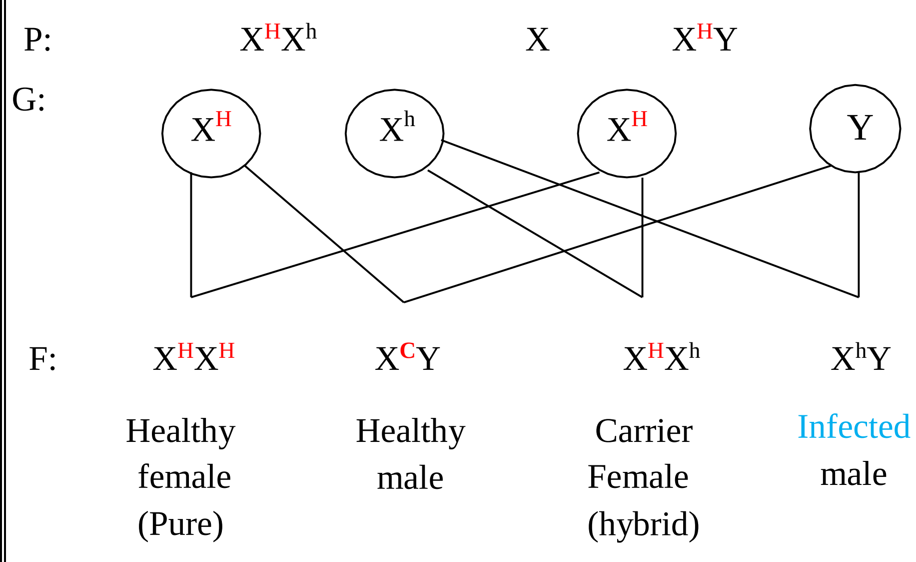
The inheritance of Hemophilia (Blood liquidity)

Haemophilia is a genetic case causes blood liquidity, due to the absence (lack) of some substancesthat are necessary for the blood clotting.

The gene of haemophilia is recessive and is carried on sex chromosome (X). The gene of haemophilia is symbolized as (X^{h}), while the normal gene is (X^{H})

	Normal vision	**Colour blinded**	**No. of genes**
Males	X^{C} Y **No carrier males**	X^{c} Y	Have only one gene for the trait (always pure)
Females	X^{C} X^{C} (Pure) andX^{C} X^{c} (carrier)	X^{c} X^{c}	Have two genes for the trait

Example What would happen when a healthy man married to a haemophilic carrier woman?



Sex-influenced traits

They are genetic traits that their genes are carried on somatic chromosomes (autosomes) not sex chromosomes but the action of these genes is influenced by the sex hormones thatare secreted from the gonads of adult males and females

The sex of the individual acts to modify the dominancy of some traits.

Examples:

1- Genetic baldness trait in humans.

2- – The presence of horns trait in cattles.

The inheritance of genetic baldness trait in humans

- Genetic baldness spreads among males of some families more than in females.
- This trait is controlled by a dominant gene which is influenced by masculinity (male) hormones
- This gene causes hair falling.
- The baldness appears in the male in the presence of **one gene only due to the presence of male hormones**, whereas in females it requires the presence of the **two genes** where the hair of the female head falls d

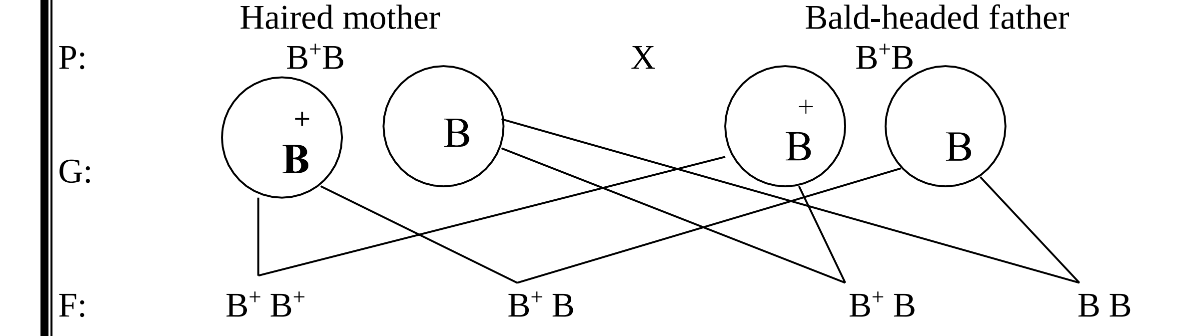
Genotype / Sex	Pure genotype (B^+B^+)	Hybrid genotype (B^+B)	Pure genotype (BB)
Male :	Male suffers from baldness, due to the : - Presence of two dominant genes. - Masculinity hormones.	Male suffers from the baldness, due to the : - Presence of one dominant gene. - Masculinity hormones.	Normal hair.
Female :	Female suffers from genetic hair falling, due to the : - Presence of two dominant genes. - Absence of masculinity hormones.	Normal hair, although the presence of one dominant gene, but it doesn't express its effect, due to the absence of masculinity hormones.	Normal hair.





Example**:**

- When a bald man marries a normal woman, both of them heterozygous, the results will be as follows:



Bald-headed male	Bald-headed male	Healthy **male**
Hair fall female	Normal hair female	Healthy female
1 :	2 :	1

Medical examinations before marriage

They are a group of medical tests which are carried out by the persons who will get married.

1-To make sure that they are free from: Infectious diseases (such as hepatitis and Acquired immunity deficiency syndrome (AIDS) Genetic diseases (Such as Thalassemia).

2-Giving the medical advice about the probability of the transmission of the previous diseases tothe other partner or offspring in the future.

3-Providing the choices or alternatives to who will get married to help them in planning for ahealthy family.

Importance of the medical tests for the persons who will get married:

- Giving birth to healthy children
- Limiting the spreading out of genetic diseases, congenital deformities (disorders) and mental retardation.
- Avoiding social, psychological and financial problems resulted from taking care of children with genetic diseases.

Sex limited

- They are traits whose appearance is restricted on one sex only ,due to the difference in sex hormones
- Milk production (female)
- Appearance of beard (males)

Work sheet

1-Which of the following results in a male and a female suffering from the colour blindness?
(a)The father suffers from the colour blindness and the mother is healthy.
(b)The mother only suffers from the colour blindness.
(c)The mother only is a carrier for the gene of this case.
(D)The father is colour-blinded and the mother is a carrier for the gene of this case.

2-A normal man married to a normal woman, but her father suffers from colour blindness. So. what is the percentage of the colour-blinded males that are resulted from this crossing ?
(a) 25% (b) 50%
(c)75% (d)100%

3- If a woman that is heterozygous for the colour blindness character is married to a man who can't distinguish the red and green colours. What is the percentage of the appearance? of this case among their daughters ?
(a) 25% (b) 50%
(c) 75% (d) 100%

4-What is the number of genotypes of the individuals suffering from a disease controlled by a dominant gene carried on sex chromosome (X)?
(a)2 (b)3
(c)4 (d) 1

5- A healthy man whose father suffers from haemophilia married to a healthy woman, where this case was not known throughout the history of her family. Which of the following represents the resulted generation?
(a) All the children are normal.
(b) All sons are haemophilic and all daughters are normal.
(c) All daughters are haemophilic.

6- Give reason for: the eye colour trait genotypes in the Drosophila female insect are more than that in males.

7- Give reason for: the colour blindness is more common among males than females.

8-Give reason for: the baldness is more common among men of some families than women.

Principles of Living Organisms
Classification

• Due to the enormous diversity in living organisms, the need for classification Process was arisen.

Classification-:

It is the arrangement of living organisms in groups, according to the similarities and the differences among them to
Facilitate their studying and identification.

Taxonomy

It is the science that concerns with the classification of living organisms in groups on Scientific bases.

Importance of classification

1-1It facilitates the study and identification of the living organisms.
2-It facilitates the identification of new organisms and adding them to their Similar groups.
3-It benefits many other fields of science.

•The modern classification system depends on the definition of the species as a scientific And basic principle in classifying the living organisms.

Species

It is a group of individuals that have similar morphological characteristics (external shape), can mate with each other and produce fertile offspring that are similar to them.

There are individuals that are not called by the term "'species", because they are Unable to mate with each other and produce a new generation of the same species, Such as:

Tigon	Mule
- It is produced from the mating of a female lion with a male tiger (Two different species). It is sterile, unable to mate, reproduce and produce a new generation of The same species.	- It is produced from the mating of a female horse with a male donkey (Two different species). -It is sterile, unable to mate, reproduce and produce a new generation of The same species.

Naming of living organisms

.The need for naming the living organisms with unified scientific names raised among the scientists, as the same organism has many names that differ in various Earth's regions and environments, and these names are known as "common names". To overcome this problem, the scientist Carolus Linnaeus developed a system for naming the organisms and gave it the name of "BinomialNomenclature System".

Conditions of writing the scientific names of living organisms in the binomial nomenclature system:

1- The name is written in Latin language.

2 The name is written with italic letters or underlined for distinguishing it from
The others.

3-Each living organism in the binomial nomenclature system is given a "binomial name, where:

-The first name represents the genus and starts with a capital letter.
-The second name represents the species and starts with a small letter.

Example
The scientific name of the domestic cat is "Felis domesticus" or Felis domesticus,
Where:-

- Felis represents the genus of the cat.
- domesticus represents the species of the cat.

Taxonomic hierarchy

There are seven levels (or groups) for classifying the living organisms.
Each group comprises a less number of organisms that have more similar characteristics than the group preceding it,

1- Kingdom
- It is the highest level in
The taxonomic hierarchy of
The living organisms.
- It includes a number of phyla.

2 -Phylum
It is a taxonomic level that
Represents the largest group
In the kingdom.
- It includes a number of
classes.

3 -Class
It includes a number of orders

4 -Order
It includes a number of
Families.

5 Family
It includes a number of genera.

6 -Genus
It includes a number of species

.

7- Species
It includes an interbreeding
Population of organisms that
Can produce healthy and fertile
offspring of the same species

Dichotomous key:-

It is a series of descriptions (characteristics) that are ordered in pairs and lead the user

To the identification of a living organism that is unknown to him.

Importance:

Biologists often use the dichotomous key to help them in identifying
The unknown living organisms.

Way of its designing:

1-lt starts with broad features, then it gets more specific and private whenever we
Proceed through the levels of dichotomous key.

2-Through each step, you can choose one of the two descriptions, according to
The characteristics of the living organism.

3-At the end, you will reach a description that leads to the organism's name
Or the group to which it belongs.

Work sheet

1-If you know that wholphin is produced from the crossing of a male whale with a female Dolphin. So, which of the following is correct about wholphin?
(a)It doesn't resemble its parents in the external shape.
(b)It is not able to reproduce.
(c)It gives fertile offspring when reproducing.
(d)It is called by the term species.

2 Which of the following increase as a result for the presence of living organisms like tigon and mule ?
(a)Individuals. (b) Genera.
(c) Species. (d) Phyla.

3- The scientific name of rat is Rattus rattus. So, which of the following represent these syllables ?
(a) Kingdom and genus. (b)Genus and species.
(c) Kingdom and species. (d) Phylum and genus.

4- If the scientific name of potato is Solanum tuberosum and the scientific name of swed sativum. So, in which taxonomic level are they different?
(a) Species (b) Kingdom.
(c) Phylum. (d)Genus.

5- The wheat plant is from the monocotyledonous plants, which of the following Expresses the scientific name of wheat correctly?
(a) Triticum Aestivum.
(b) triticum aestivum.
(c) triticum Aestivum.
(d) Triticum aestivum.

6-Which the following can't be used for making a dichotomous key to recognize the animal shown in the opposite figure ?
(a)The beak (longer or shorter) than the head.
(b)The head vertex (white or black).
(c) The reproduction (sexual or asexual).
(d)The skin membrane among toes (present or absent).

7- What happens in case of: the absence of classification system for living organisms?

8-"In some cases, new individuals are produced from the crossing of two different species of living organisms". How far is this statement correct? With explanation.

9- The following living organisms represent a group of vertebrates:
(Frog- Crocodile - Hawk - Cat)
Design a bilateral dichotomous key to classify these organisms, depending on the following characters according to their arrangement :

• The type of skin (naked or covered).
• 1he type of the skin cover (hairs or scales).
• The scales (scales along the body or scales on the legs).

• Kingdom Monera.
• Kingdom Protista.

- Attempts of classifying the living organisms :

1-The Latin philosopher Aristotle

• He was the first who classified:
- The animals into red-blooded animals and bloodless animals.
-The plants into trees, shrubs and weeds.

2-The scientist Carolus Linnaeus

.He established the traditional classification system, where he Classified the Living organisms into two kingdoms only, which are:
- Animal kingdom. -Plant kingdom.

3-The scientist Robert H. Whittaker

He established the modern system of classification, where he classified The living organisms into five kingdoms, which are:
- Monera. - Plantae.
- Protista. -Fungi.
- Animalia.

•The development of the scientific techniques that used in the biological field and increasing the knowledge had helped Whittaker in establishing his modern classification system. This modern system is considered the conventional system in the scientific Communities till now.

Note:-

There are some organisms that were not subjected to Whittaker's classification, because they gather between the characteristics of living organisms and non-living things, and from the examples of these organisms are:

(1) Viruses, like: Poliomyelitis.
• HIV
• Influenza.
• Measles.

(2) Viroids.

(3) Prions.

First Kingdom Monera

•**Mode of living**: it can live individually or in colonies.

• **Structure**: its body consists of one cell (unicellular organism).

• Nucleus: it is prokaryotic, i.e. it doesn't have a definite shape, where the genetic material is found in the cytoplasm and not surrounded by a nuclear membrane from outside.

•**Cell wall**: it is devoid of cellulose or pectin.

•Cytoplasm: many membranous organelles, such as mitochondria, plastids, Golgi apparatus and endoplasmic reticulum are not found in it.

- Kingdom Monera is classified into two different divisions which are :

1- Archaebacteria. 2- Eubacteria.

1- Archaebacteria

• Mode of living: most of them survive in harsh environmental conditions, such as:
- Environments devoid of oxygen.
- Hot springs.
- High salty environments.

They differ from the eubacteria in the structure of both cell membrane and ceil wall.

2 -Eubacteria

• Mode of living: they live everywhere in all Earth's environments, such as:
- Air.
- Land.
- Water.

- **Nutrition** : some of them are autotrophic, such as Cyanobacteria, e.g. Nostoc, while others are heterotrophic.

- **Reproduction:** they reproduce asexually by binary fission.

• Shapes: they have several shapes (forms), such as:

1-Spherical-shaped (bacteria (Cocci)

2-Rod-shaped (bacteria (Bacilli)

3-Spiral-shaped (bacteria (Spirilla)

Second: Kingdom Protista

- **Structure** : their structure is not complex, as most of them are unicellular and **Few** of them are multicellular.

- **Nucleus :** it is eukaryotic, i.e. the genetic material is surrounded by a nuclear Envelope that separates it from the cytoplasm.

- They are different from plants and animals, as they are not complex in their su Structure some of them have cell wall and plastids.

Kingdom Protista is classified into several phyla, the most important ones are:
1-Phylum Protozoa
2-Phylum Euglenophyta
3-PhylumChrysophyta
4-Phylum Pyrrophyta

1- Phylum Protozoa

- **Mode of living :**

- Some of them are free-living, where they may live individually or in colonies in fresh And salt water, as well as in moist soils.

-The others parasitize the plants or animals, causing diseases to them.

- **Structure :**

_They are unicellular microscopic animal-like organisms.

•Reproduction:

They reproduce sexually and asexually.

• Phylum protozoa is classified into **four classes**, depending on the mean of locomotion:

1- Class Sarcodina:-

- Mean of locomotion: Pseudopodia

(Temporary extensions from the body).

- Examples: amoeba

2- Class Ciliophora:

- Mean of locomotion: Cilia (Surrounding the whole body).
- Examples: Paramecium

3- Class Flagellata:

Mean of locomotion: Flagella
Examples: Trypanosoma

- (Parasitizes the human and infects him with sleeping sickness).

4- Class Sporozoa:

Mean of locomotion: Have no mean of locomotion
Examples: Plasmodium
(Parasitizes the human and infects him with malaria disease)

2 -Phylum Euglenophyta

Structure: unicellular living organisms.

Cytoplasm: it contains green plastids (chloroplasts) which perform photosynthesis.

Mean of locomotion: they move by flagella.

•Example: Euglena.

3- Phylum (Chrysophyta)

Structure: Most t of them are unicellular and called Diatoms.

They have glass-like cell walls containing silica.

- **Economic importance:**

They are considered an important source of food for fish and other marine animals.

4- Phylum Pyrrophyta

•**Mode of living**: they live in seas and oceans, where they form a great portion of phytoplanktons.

• They contain a red pigment which provides them the red colour, besides the Chlorophyll pigment.

•Example:
Dinoflagellates represent the largest group of phylum Pyrrophyta and they move by two flagella.

Work sheet

1-Which of the following organisms doesn't/don't have a level in the taxonomic Hierarchy?

(a) Spirogyra. (b) Prions.
(c) Euglena. (d) Nostoc.

2 -Which of the following organisms is classified by the scientist Whittaker in the mod Classification system?

(a) HIV (b) Prions of mad cow disease.
(c) Malaria Plasmodium. (d) Tomato apical stunt viroid (TASVA)

3 Which of the following diseases is caused by an organism that is not classified According to the modern classification system?

(a) Malaria disease. (b)COVID-19
(c)Elephantiasis (d) Sleeping sickness.

4-Which of the following characterizes all monerans?

(a)Living in definite environments.
(b) Having a nucleus with a definite shape.
(c) Dividing meiotically
(d) Dividing mitotically only.
(b) The mean of locomotion.

5- What is the difference between Euglena and dinoflagellates ?

(a) The number of body cells,
(b)The mean of locomotion.
(c) The mode of nutrition.
(d)The type of pigments.

6- Which of the following organisms has-(have) plastids in its(their) cytoplasm ?

(a) Archaebacteria. (b) Euglena.
(c) Plasmodium. (d) Paramecium

1-"All protozoans are mobile living organisms". How far is this statement correct? With explanation.

2What are the similarities and differences between: Nostoc and Amoeba?

5-"Pyrrophyta contain red pigment only". How far is this statement correct? With explanation.

6 If you have three slides (Amoeba - Euglena- Paramecium). How can you identify each one of them ?

• Kingdom Fungi.
• Kingdom Plantae.

Third: Kingdom Fungi

• **Structure:** some fungi are unicellular and the majority are multicellular, they are Composed of fungal filaments called hyphae that are gathered to form the mycelium.

•**Nucleus**: it is eukaryotic.

• **Cell wall**: lignin substance enters in its structure

• Locomotion: they are immobile.

• **Nutrition**: they are heterotrophic, where some of them are parasites and others are Saprophytes.

Reproduction: the majority reproduce sexually, as well as they reproduce asexually by Producing spores.

• Kingdom Fungi is classified depending on the structure and ways of reproduction

Into five phyla (divisions), the most important ones are :

1-Division: Zygomycota

2-Division: Ascomycota

3-Division: Basidiomycota

1-Division: Zygomycota
The hyphae are not divided and the spores are produced inside sporangia.
Example: Bread mould fungus (Rhizopus nigricans) which:
• Causes the black putrefaction on bread.
• An enzyme is extracted from it that is used in cheese industry.

2-Division: Ascomycota
Some of them are unicellular while others are multicellular with hyphae that are divided by
Septa, and the spores are produced inside sac-like structures called asci.
Examples
- Yeast fungus (unicellular).
- Penicillium (multicellular)
Which produces the penicillin antibiotic.

1-Division: basidiomycota
The hyphae are divided by septa, and spores are produced inside a club- shaped structure called basidium.
: Example
Mushroom fungus which some of its types are used as human food.

Fourth: Kingdom Plantae
•**Nucleus:** it is eukaryotic.

Cell wall: it consists of cellulose.

•**Cytoplasm**: it contains chloroplasts (green plastids) that contain chlorophyll substance.

Reproduction: the majority reproduce sexually.

Kingdom Plantae is classified into three groups, as follows:
1 –Higher algae
2- Non-vascular. plants
3-Vascular plants

1- Higher algae
• The higher algae include three phyla:

-1Phylum Rhodophyta	• They are marine weeds that consist of filaments sticking together by a gelatinous coat. • Their cells contain chromatophores of red pigments. So, they are called red algae. • Example Polysiphonia alga
2- Phylum:Phaeophyta	• They are marine weeds that consist of simple or branched filaments. • Their cells contain chromatophores of brown pigments. So, they are called brown algae. Example Fucus alga
3- Phylum Chlorophyta :	Some of them are unicellular while others are multicellular. • Their cells contain chloroplasts. So, they are called green algae. Examples - Chlamydomonas alga (unicellular) : it contains a cup-shaped plastid. Spirogyra alga (multicellular) : it takes the form of unbranched filaments and its cells contain spiral-shaped plastids

2 -Non-vascular plants

They are plants that don't contain vascular tissues which are specialized in transporting Water or food. So, they are called non-vascular plants and represented in :

Phylum Bryophyta (Mosses)
•They are terrestrial plants that live in damp soils and shaded places, because they need high dampness to grow and reproduce.
• they are small-sized plants, green in colour and have hairs for anchorage (rhizoids).

- Examples

1- Riccia which is flat.
2-Funaria which is erect.

3- Vascular plants

•They are plants that contain specialized vascular tissues for transportation, which are:

- Xylem which transports water and mineral salts from root to stem, then to leaves.
- phloem which transports the organic substances that are formed during photosynthesis Process from leaves to all the plant parts. So, they are called "vascular plants".

• Phylum Tracheophyta is classified into three classes, which are :

1-Class Filicatae (Ferns) :	• They are simple-structured plants, where most of them are herbs a few are shrubs or trees that have stems, leaves and roots, • They live in shaded-damp regions, such as the walls of wells and Shaded-damp valleys. • They carry pinnate leaves. • They don't produce flowers or seeds. • They reproduce asexually by spores that are found in special structures on the lower surface of leaves Examples - Adiantum - Polypodium
2-Class gymnosphermae	• Most of these plants are trees and a few are shrubs. •They carry simple needle-shaped leaves. •They don't form flowers Gymnosperm(Conifers) : • They carry male and female cones. • They produce naked seeds (without coat” pericarp"). So, they are called by Gymnospermae. • They reproduce sexually. Example - Pinus

3-Class :Angiosperm Flowering plants	• They are terrestrial plants that have stems, leaves and roots. • They produce flowers that change into fruits which enclose seeds. So, they are called by Angiospermae. • They are classified into two groups (subclasses), which are - Monocotyledons. - Dicotyledons.

- Class Angiospermae is classified into two groups (subclasses), which are :

Taxonomic characteristics	Subclass Monocotyledons	Subclass Dicotyledons
Seeds:	• One cotyledon.	•Two cotyledons.
Leaves	• Leaves are narrow. • Parallel-veined.	• Palmate or Pinnate-veined.
Flowers	With trimerous whorls or their multiples	• With tetramerous or pentamerous whorls Or their multiples.
Stem:	Bundles of vascular tissues are scattered Inside the stem.	•Bundles of vascular tissues are arranged in a ring inside the stem
Roots:	• Fibrous	• Tap.
Examples:	• Wheat, maize, banana., onion cactus, lily and Palm.	• Pea, bean, orange, Rose and cotton.

Work sheet

1- Which of the following characterizes the organisms that consist of hyphae?

(a) They are parasites. (b) They are prokaryotes.

(c) they are uni-cellular (d) they are multi-cellular

2- Which of the following fungi doesn't consist of hyphae?

(a)Bread mould fungus. (b) Penicillium.

(c) Yeast fungus. (d) Mushroom fungus.

3- What is the type of the formed fungi, when leaving a piece of bread in a warm place for several days ?

(a) Multicellular basidiomycete. (b)Unicellular ascomycete.

(c) Multicellular zygomycete. (d) Multicellular ascomycete.

4- Which of the following living organisms doesn't/don't have nuclear membrane?

(a) Penicillium. (b) Amoeba.

(c) Bacteria. (d) Bread mould fungus.

5- Which of the following organisms is less advanced in the modern classification system ?

(a) Riccia. (b)Polypodium.

(c)Polysiphonia. (d) Cactus.

6- Which of the following plants is a non-flowering plant that differentiates into male or female?

(a) Palm plant. (b) Pea plant.

(C) Pinus. (d) Adiantum.

7- Which of the following features characterizes the plants that have the parallel venation of leaves ?

(a) They have fibrous roots.

(b) They don't form flowers, but form seeds.

(c) They don't form flowers or seeds.

(d)They have bundles of vascular tissues arranged in a ring inside its stem.

8- Which of the following features characterizes the plant that has tap roots ?

(a) It carries male and female cones.

(b) It has no vascular tissues.

(C) It has flowers with tetramerous whorls or their multiples.

(d)It has flowers with trimerous whorls or their multiples.

10-- Which of the following is not from the characteristics of Pinus plant ?

(a) The presence of vascular tissues.

(b) The seeds are coated with pericarp.

(©) The presence of two types of gametes.

(d) The leaves are simple with needle shape.

11-What happens if : Riccia is located in a dry environment ?

12-Explain: green plants are autotrophic, while fungi are heterotrophic.

13- Explain: Pyrrophyta differs from Rhodophyta, despite of being similar in colour and mode of nutrition.

14- Determine: the taxonomic standard upon which the bean plant is classified

As Dicotyledonous plant.

15- "Polypodium belongs to phylum Bryophyta". How far is this statement correct? With explanation.

Kingdom Animalia

Lesson One

Fifth: Kingdom Animalia

- Structure: all of them are multicellular.
- Nucleus: it is eukaryotic.
- Locomotion: they have the ability to move from one place to another.
- Responding to stimuli: they have the ability to respond rapidly to the external stimuli in the surrounding environment.
- Reproduction: most of them reproduce sexually.

•The phyla of kingdom Animalia are divided into:

1- Invertebrates: they don't contain a vertebral column.

2- Vertebrates: they contain a vertebral column inside their bodies.

•Kingdom Animalia is classified into nine phyla, according to the complexity degree of the body, as follows:

Kingdom Animalia

1-Phylumn: Porifera

2-Phylum: Cnidaria

3-Phylum: Platyhelminthes

4-Phylum: Nematoda

5-Phylum: Annelida

6-Phylum: Arthropoda

7-Phylum: : Mollusca

8-Phylum: Echinodermata

9-Phylum: Chordata

1- Phylum Porifera (Sponges)

- Most of them live in seas and oceans and a few of them live in fresh water.
- They live individually (solitary) or in colonies.

Locomotion: they are immobile, where they live attached to rocks.

Body:

- It is simple-structured and asymmetric.
- Its shapes are varied, where it maybe tubular or vase-shaped.
- It is hollow, its wall is supported by a skeleton of spicules Osculum

Or fibers or both of them, contains many pores and canals. Therefore, sponges Are known as poriferans.

- Its cavity opens to outside by a large top opening called osculum.

• **Sex:** the majority are hermaphrodite.

• **Reproduction**: they reproduce sexually by gametes And asexually by budding and regeneration.

Example Sponge animal

2 -Phylum Cnidaria

Mode of living: the majority are marine, where they live individually or in Colonies in water (1.e. they are aquatic animals).

Body:

-It doesn't have a head.

-It has radial symmetry.

- It has a mouth that is surrounded by appendages and protrusions (Extensions) called tentacles.

-It has a cavity called "gastrovascular cavity".

- Its cells are arranged in two layers of tissues, where the outer one contains cnidocytes (stinging cells) which are found in plenty on the tentacles for self-defense and capturing preys.

Examples Hydra - Aurelia - Sea anemone.

3- Phylum Platyhelminthes (Flatworms)

• **Mode of living**: the majority are parasitic on two hosts and a few are free-living.

• Body:

- It has a head.

- It is flat. So, they are called flatworms.

- It is composed of three layers (triploblastic) and is bilaterally symmetric.

• Sex: the majority are hermaphrodite and a few are (separated) unisexual.

Examples: Planaria worms - Bilharzia worms - Tapeworms.

4 -Phylum Nematoda (Roundworms)

•**Mode of living**: they live in all environments, where some of them are free-living in water or mud, and the others parasitize the human, animals and plants.

. Body:

- It is cylindrical, tapered at its two ends and unsegmented.

- It consists of three layers and is bilaterally symmetric.

- It has an alimentary canal with two openings which are mouth and anus.

- Its size ranges from the microscopic to about one meter in length.

• Sex: unisexual.

Examples -Ascaris worms. -Filaria worms.

Filarial worms exist in the tropical regions of Asia continent.

They parasitize the human blood and lymphatic vessels, causing elephantiasis

Disease

5- Phylum Annelida (Ringworms or segmented worms)

Mode of living: the majority are free-living in sea, fresh water or muddy soils and a few are external parasites.

Body:

-It is divided into rings (segments).

-It has chaetae (spine-like structures) that are buried in the skin of most worms

To help them in movement.

Sex: some are unisexual and a few are hermaphrodites.

Examples:

1-Earthworms which live inside the soil in burrows, where they aerate the soil and increase its fertility.

2-Leech which is external parasitic.

Medical importance of leech worms:

Many medical substances are extracted from their saliva, such as:

- Hirudin substance which is used in making anticoagulant drugs and in the treatment of the middle ear inflammation.
- Vasodilator substance which is used to widen the blood vessels.

6 -Phylum Arthropoda

Body:

-It is bilaterally symmetric.

It is divided into a number of segments which carry many pairs of appendages that divided into several jointed pieces.

It is divided into several regions that are covered by an exoskeleton.

- . Phylum Arthropoda is classified into four classes, which are :

1-Class Myriapoda

2-Class Insecta

3-Class Arachnida

4-Class Crustaceans

1-Class Myriapoda

Body:-

The body consists of two regions which

Are the cephalothorax and abdomen. It is covered with a chitinous cuticle.

Legs:-

They have many jointed appendages that are modified into different forms to perform various functions

Eyes:-

Their eyes are compound

Respiration:-

They breathe by gills.

Examples:

- Prawn. - Crab (Sea cancer)..

- Lobster.

2-Class Insecta

The body consist of two regions the cephalothorax and abdomen.

Legs:-

They have four Pairs of walking legs they are unisexual (separated).

Eyes:-

Their eyes are simple.

Respiration:-

They breathe by tracheoles or lung books.

Examples:- - Spiders. -Scorpion

3-Class Arachnida

The body consists of three regions which are the head, thorax and abdomen.

Legs:-

They have three pairs of walking legs. Some types have two pairs of wings such as (butterfly and dragonfly), while there are types have one pair of wings

such as (houseflies and mosquitoes), and wingless types as (ants).

Eyes:-

They have one pair of compound eyes and one pair of antennae.

Respiration:-

They breathe by tracheoles.

Examples

- Flies. - Mosquitoes. -Cockroaches.- Ants.

- Moths. - Locusts.- Dragonfly.

4-Class Crustacea

Body

The body consist of two regions which are the head and trunk that is Composed of several segments.

Legs:-

They have many walking legs.

Respiration:-

They breathe by tracheoles.

Examples Scolopendra

7- Phylum Mollusca:-

Mode of living: the majority live in salt water, some in fresh water and a few on land.

Body:

-It is a soft mass.

-it his unsegmented and has a muscular part used in locomotion called foot.

-t has a well-developed head (carries sense organs) and it may be absent in some species.

-it has a calcareous shell which may be external or internal, absent or reduced.

It has an organ that is similar to the tongue (in most molluscs), carrying rows Of teeth which is called radula that is used in feeding.

Sex:

Majority are unisexual and a few are hermaphrodites.

Examples: Desert snail - Oyster - Octopus.

8 –**Phylum:- Echinodermata**

• Body:

- It may be rounded or cylindrical or star-shaped and some of them may have arms.

It is unsegmented and has a hard endoskeleton.

- Its wall has spines and calcareous plates (in most of them).

- It has sucker-like structures called tube-feet.

•**Locomotion**: they move by tube-feet or spines or arms.

• The ends: they have no anterior or posterior ends, where the majority have

Two Surfaces (sides)

- The surface (side) where the mouth is located, is called the oral surface.

- The opposite surface (side) is called the aboral surface.

• Sex: unisexual.

•**Reproduction:** they reproduce sexually by gametes and asexually by regeneration.

Examples Sea star - Sea urchin - Sea cucumber.

Work sheet

1- Which of the following worms is different in its mode of living from others?

(a) Hepatic worm (liver fluke). (b) Ascaris worm.

(c) Bilharzia worm. (d) Earthworm.

2- What happens as we move from phylum Platyhelminthes to phylum Nematoda? Till reaching phylum Annelida?

(a) Parasitism increases and free-living character decreases.

(b) Free-living character increases and parasitism disappears.

(c)Free-living character increases and parasitism decreases.

(d)Parasitism increases and free-living character disappears.

3- Which of the following statements is not applied to the desert snail?

(a)It has a soft mass body .(b) It has an external calcareous shell.

(c)It has an organ that is similar to the tongue carrying rows of teeth.

(d)It moves by arms.

4- Which of the following is from the common features between the sea cucumber and the desert snail ?

(a) The site of the skeleton. (b)The unsegmented body.

(c) The absence of head. (d)The foot shape.

5- Which of the following characterize all molluscs and echinoderms?

(a) Having segmented bodies. (b) Having head.

(c)Having the ability to move. (d)Being unisexual.

6-Which of the following represents the taxonomic standard upon which the sea star Belongs to phylum Echinodermata?

(a) The endoskeleton. (b) Being unisexual.

(c) The segmented body. (d) The presence of calcareous plates.

7- Which of the following is from the differences between the sea urchin and the sea Cucumber?

(a) The habitat. (b) The sex.

(c) The main mean of locomotion. (d)The reproduction type.

8-"The body of all arthropods is covered by calcareous shell". How far is this so? Correct? With explanation.

9-"Earthworm is from the useful worms". How far is this statement correct 2 With explanation.

10- What happens in case of: the absence of chaetae that are buried in the skin of? Most ringworms?

11- "The method of respiration in each of the crab and mosquitoes is similar". How far is this statement correct? With explanation.

12- "The presence of one pair of antennae is one of the main taxonomic standards in the Classification of arthropods". How far is this statement correct?

9- Phylum Chordata

It includes the most developed animals in kingdom Animalia.

The embryos of chordates are characterized by the presence of a skeletal structure at its dorsal region called the notochord which may either persist throughout the animal whole life or converted into a vertebral column in the majority of chordates.

Phylum Chordata is classified into several subphyla, the most important one is:-

1-subphylum Vertebrata.

The notochord appears in vertebrates in the embryonic stage and as the embryo grows up, it’s gradually replaced by the vertebral column which surrounds and protects the spinal cord.

They have an endoskeleton which consists of the vertebral column, skull, girdles and limbs.

They have circulatory system which consists of:

1-A heart that consists of several chambers.

2-Blood vessels in which blood flows in a closed circulation to supply all the body organs with oxygen and nutrients.

Class: Agnatha

• **Endoskeleton**: cartilaginous.

. Body: thin, long and eel-like with no paired fins.

. **Mouth:** circular, funnel-shaped, contains a rough tongue, provided with many horny teeth and jawless.

• **Feeding**: they are parasites, where they stick by their mouth to the big fishes

And attach themselves by the teeth, then they snap the flesh of these fishes by

Their rough tongue which is similar to the rasp.

Example Lamprey

B -Class Chondrichthyes

Habitat: they live in salt water as seas.

.Endoskeleton: cartilaginous.

• **Body**: covered by bony scales. That are similar

To teeth.

Mouth: ventral, i.e. it lies on the ventral side of the head and provided by two jaws that carry several rows of teeth, helping them in predation.

Fins: they are paired.

Gills slits: they are not covered with an operculum

• **Air bladder**: they have air bladder,

•**Sex:** separated (unisexual).

Fertilization: internal.

Examples:

- Shark. - Ray fish.

C- Class Osteichthyes

• **Habitat:** they live in salt or fresh water.

• **Endoskeleton:** bony.

Body: covered with scales bony

• **Mouth**: terminal, i.e. it lies at the anterior tip of the body

•**Fins:** they are medial and paired.

• **Gills slits:** they are covered with an operculum

Air bladder: they have no air bladder helping them in swimming and floating.

• **Sex:** separated (unisexual).

. **Fertilization**: external.

Examples

- Bolti (Tilapia).

- Pori (Mullet).

D- Class Amphibia

•They are cold-blooded animals.

• **Body** : covered by a smooth slimy skin.

• **Limbs**: they have four pentadactyl limbs.

•Respiration: it takes place by several different ways according to the stage

Of its growth, as follows:

- Embryonic stages: they breathe by gills, because they live in water.
- Adult stages: they breathe the atmospheric air by lungs and skin, because they live on land.

•Sex: separated.

•Fertilization: external.

• The females lay eggs in water.

Examples

- Frog (toad).

- Salamander.

E- Class Reptilia

They are cold-blooded animals.

Body:-It consists of four regions which are the head, neck, trunk and tail.

- It is covered by a dry skin with thick horny scales and sometimes it may be supported by horny plates.

Limbs: they have four weak pentadactyl limbs and each toe ends with a horny claw.

The limbs may be absent. So, some of them move by creeping.

Respiration: they breathe the atmospheric air by two lungs.

Sex: separated.

Fertilization: internal.

The females lay eggs with calcareous or skiny shell.

Examples

-Crocodile - Tortoise. -Chameleon.

-Gecko. - Snake. - Lizard.

Chameleon

F:class aves

• They are warm-blooded animals.

Body: covered with feathers.

• **Limbs:** they have four limbs, where :

-The two anterior ones are modified into two wings for flying.

-The two posterior ones each one ends by four digits that are provided with

Horny claws which are used for:

Moving on ground-Or-Climbing-Or-Swimming-Or- Predating

Respiration: they breathe by lungs.

Sex: separated.

Fertilization: internal.

• The females lay eggs and incubate them till hatching.

•Appropriateness (Adaptability) of internal structures of birds for flying:

- Their bones are hollow and light.

- The sternum is broad for the attachment of the strong thoracic muscles which move the wings during flying.

-Their bodies contain air sacs which are considered the storehouses for the additional amounts of air during flying.

Examples

- Sparrow. – Pigeon - Hawk.

- Duck. -Chicken. - Ostrich.

- Eagle.

Class Mammalia

•they are warm-blooded animals.

Body :

-It consists of four regions which are the head, neck, thorax and abdomen

-It is surrounded by skin that is covered with hair.

•Limbs: they have four pentadactyl limbs that are provided with:

Hooves-Or-Pads-Or Claws or Nails

• Respiration: they breathe the atmospheric air by lungs.

•Teeth: they are dissimilar (incisors, canines and molars).

• Sex: separated.

•Fertilization: internal.

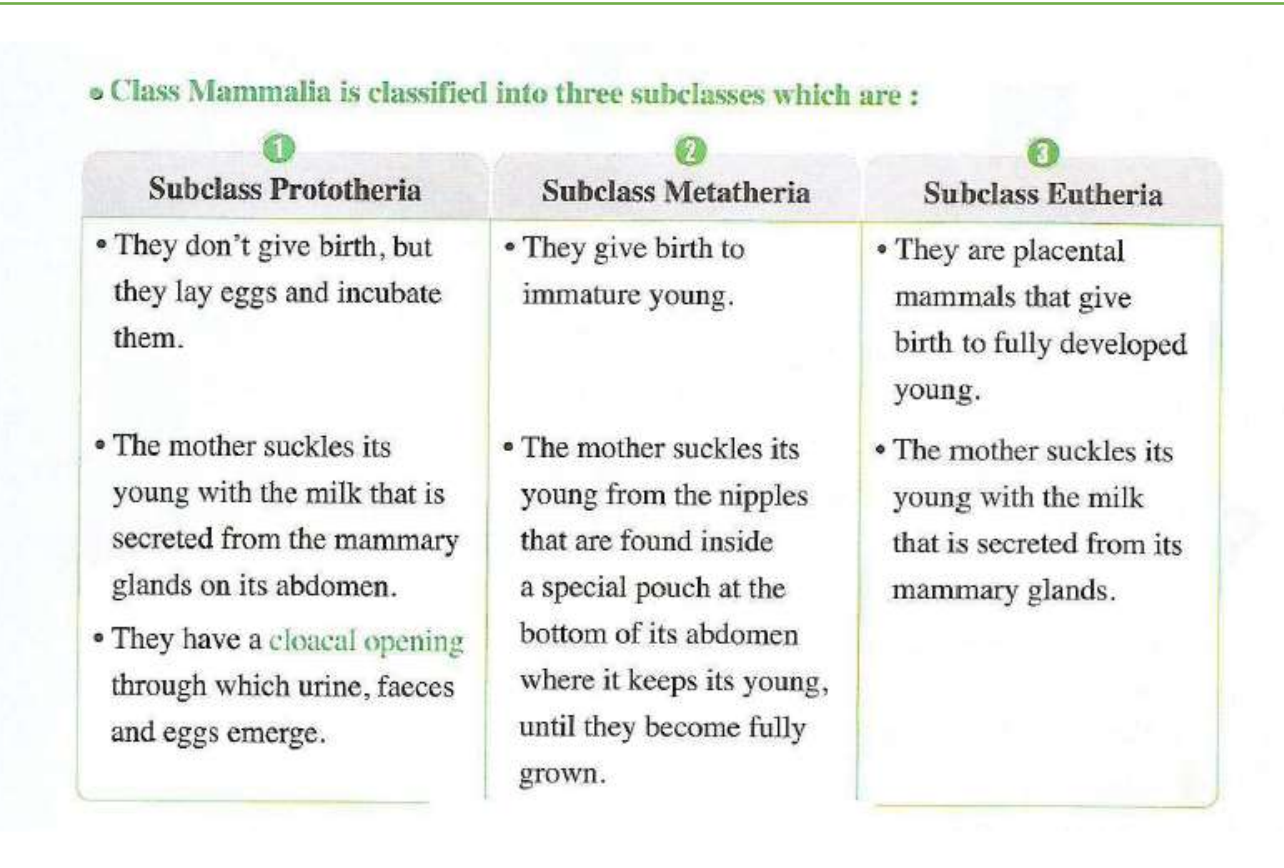
• The majority of females are viviparous and have mammary glands that secrete milk to suckle their young.

.Class Mammalia is classified into three subclasses which are:

Subclass Metatheria

Subclass Butheria

Subclass Prototheria



• Class Mammalia is classified into three subclasses which are :

1 Subclass Prototheria	2 Subclass Metatheria	3 Subclass Eutheria
• They don't give birth, but they lay eggs and incubate them.	• They give birth to immature young.	• They are placental mammals that give birth to fully developed young.
• The mother suckles its young with the milk that is secreted from the mammary glands on its abdomen. • They have a cloacal opening through which urine, faeces and eggs emerge.	• The mother suckles its young from the nipples that are found inside a special pouch at the bottom of its abdomen where it keeps its young, until they become fully grown.	• The mother suckles its young with the milk that is secreted from its mammary glands.

Examples

- Duck-billed platypus.
- Spiny ant-eater.



Duck-billed platypus



Example

- Kangaroo.



Kangaroo

- Eutheria include many animals that are headed by the human, it is divided into many orders, the most important ones are :

(1) Order Edentata.

(2) Order Insectivora.

(3) Order Carnivora.

(4) Order Perissodactyla.

(5) Order Artiodactyla.

(6) Order Cetacea.

(7) Order Rodentia.

(8) Order Lagomorpha.

(9) Order Chiroptera.

(10) Order Proboscidea.

(11) Order Primates.

Sub class euthera is classified into many orders such as

Order	Characteristics	Examples
Edentata	• Some of them are toothless, While the others lost their front teeth only. • They have strong and curved claws.	- Armadillo. - Sloth.
Insectivorae	• They feed on insects. Their front teeth are extended outward like pincers for capturing the prey	- Hedgehog.
Carnivore	•They have large pointed canines. • The premolars are sharp while the molars are broad for grinding. • They have strong, sharp and curved claws.	- Lion. - Wolf. - Dog. - Seal. - Tiger. - Fox. - Cat.
Perissodactyle	They are herbivorous animals. • They are odd-toed (1 or 3). • Each toe has a horny hoof. •Their teeth are big-sized and adapted to grind food.	•- Horse. - Donkey. - Zebra. - Rhinoceros
Artiodactyla	• They are herbivorous animals. They are even-toed. Each toe is coated with horny hoof	- Sheep. -Goat. Giraffe. - Deer. -Camel.

Order	Characteristics	Examples
Cetacea:	They are huge aquatic animals that live in seas and oceans • Their two forelimbs are ➢ Modified into paddle-like Structures for swimming. While their hind limbs are disappeared. ➢ Tail fin is horizontal. ➢ They breathe the atmospheric air by two lungs. • Sexes are separated. •The females give birth and suckle their young.	Whale. - Dolphin
Rodentia:	They have a pair of incisors in both the upper and lower jaws. The incisors are sharp and chisel-shaped The tail is long and ears are small.	- Rat. -Gerbo. - Mouse. - Squirrel. Mouse
Lagomorpha:	• They have two pairs of Incisors in the upper jaw and One pair in the lower jaw. •The tail is short and ears are Long	- Rabbit.
Chiroptera	Their forelimbs are modified into wings, where the fingers from the 2nd to the 5" are elongated and the skin extends from the body to in-between these fingers. • They are active during night.	Bat.

Proboscidea:	• They have a long muscular Proboscis. • The two upper incisors Grow to form what is known as the two elephant canines.	- Elephant.
Primates: .	• They are the most higher Mammals. • They have two pairs of Pentadactyl limbs, and the thumb of the upper limbs lies away from the rest fingers. •The brain is large-sized And the nervous system is Highly developed in The higher forms.	- Monkey. - Lemur. - Gorilla. Chimpanzee. - Human

Work sheet

1-Which of the following is from the common characteristics in all mammals?

(a) The mother gives birth to young.

(b) The mother suckles its young.

(c)The born individuals were fully developed.

(d) The mother gives birth and suckles its young.

2 -Which of the following doesn't characterize the whale?

(a) Its body temperature is constant.

(b) The forelimbs are modified into paddle-like structures.

(C) It breathes like the rest aquatic organisms.

(d)The hind limbs are disappeared.

3 -What is the common character does the rabbit share with the squirrel?

(a)The order to which they belong.

(b)The tail length.

(c) The number of incisors in the upper jaw.

(d) The number of incisors in the lower jaw.

4- What is the difference between rhinoceros and deer?

(a) The number of limbs. (b)The class to which they belong.

(c) The mode of nutrition. (d) The number of toes.

5- What is the difference between bat and hawk?

(a)The type of fertilization. (b) The number of toes in the hind limbs.

(c)The modification of forelimbs. (d) The mean of locomotion.

6- Which of the following mammal's characteristics characterizes hedgehog?

(a) Its young need care after birth. (b)It lays eggs.

(c)Its young need to complete their growth after birth.

(d) It doesn't suckle their young.

7-Which of the following doesn't characterize the rabbit?

(a)It has a pair of incisors in the upper jaw.

(b)The tail is short.

(c) It has a pair of incisors in the lower jaw.

(d) The ears are long.

8-Which of the following is from the animals that can fly and suckle

Their young?

(a) Ostrich.
(b) Hedgehog.

(c) Duck-billed platypus.
(d)Bat.

9-The skin extension between the toes of the forelimbs is a characteristic feature

For a mammal that

(A) Its hind limbs are disappeared.
(b) Its young are immature.

(c) is a protozoan animal.
(d) is active during night.

10-What is the taxonomic standard upon which Lamprey is classified as class Agnatha?

11-What happens if: reptiles are from warm-blooded animals?

12-What happens if: the bones of the seagull become solid and the thoracic muscles become weak? Explain your answer.

13-What is the taxonomic standard upon which:

(1) Salamander is classified as Amphibia.

(2) Crocodile is classified as Reptilia.

14- Explain : the adaptability of the internal structure of quail for flying.

1- Which blood group contains antibodies (anti-a) only?
(a) (A). (b)(B).
(c)(AB). (d)(0)

12- A man with blood group (A) married to a woman with blood group (B), they gave bith to
a child with blood group (0), what are the genotypes of the parents blood groups ?
(a)AA x BB
(b) AO x BB
(C) AA x BO
(d) AO x BO

3 A mother whose blood group is (AB) has a son with the same blood group, what is the excluded blood group for the father ?
(a)A
(b) B
(C) AB
(d)O
15 * How many genotypes of the blood groups containing antigens (A) or (B) and containing antigens (A) and (B) together ?
(a)3
(b) 4
(c)5
(d)6
16 When a man with blood group (AB) married to a woman with blood group (O), what is
the percentage of giving birth to children having the same blood groups of parents ?
(a) 75% (AB) and 25% (0).
(b)0% (AB) and 0% (0).
(c)50% (AB) and 50% (0).
(d) 25% (AB) and 75% (0).
26 Which of the following blood groups have antigen (B) ?
(a)(A) and (0).
(b) (B) and (0).
(c)(AB) and (B).
(d)(AB) and (A
28 A man whose blood group is (A) married to a woman has the same blood group, what is

